QUALITY MEASUREMENT OF TRANSPORTATION SERVICE APPLICATION USING ISO 25010 QUALITY MODEL (CASE STUDI: GO-JEK)

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ABSTRACT

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QUALITY MEASUREMENT OF TRANSPORTATION SERVICE APPLICATION USING ISO 25010 QUALITY MODEL (CASE STUDI: GO-JEK)).
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GO-JEK is the most widely used transportation service application by Indonesian society that its users reached 21.6% of the total users of transportation service application. GO-JEK application has 12 services include many functions that must running well. The services can be ordered by multiple users in the same time. Based on that kondition, quality of GO-JEK application need to be measured that all functions running well or not. So, the result will be better application performance using mobile application quality measurement standards ISO 25010 Quality Model. Testing result of all subcharacteristics in ISO 25010 Quality Model, quality of GO-JEK application in Product Quality dimension is 79.30% on Android device and 80.88% on iOS device from maximum product quality value of mobile application is 91.37%. While in Quality in Use dimension is 76.22% from maximum quality in use value of mobile application is 94.75%. These things show GO-JEK application have a good quality in product quality dimension and in quality in use dimension or the user's perspective.

Bibliography (2005-2016)

CURRICULUM VITAE

Millati Izzatillah was born in Jakarta on June 14th, 1993. Author graduated the elementary school in SDN Kebagusan 04 Pagi on 2005, junior and senior high school in MTS/MAS Alzaytun on 2011. After that, author continued to Gunadarma University majoring in Information System. Author got SarMag (Sarjana Magister) Scholarship Program from Gunadarma University on 2012. Author got bachelor's degree on 2015 with the title of research is "IMPLEMENTATION AND TESTING AFFINITY PROPAGATION AND ADAPTIVE AFFINITY PROPAGATION ALGORITHMS IN STUDENT DATA BASED ON GPA AND HOME DISTANCE". Now, author is taking magister program (Magister Management of Information System) concentrate in Business Information System.

Jakarta, November 2016

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PREFACE

Praise and thanks raised to ALLAH SWT for all blessing, salute to The Prophet Muhammad SAW, and also thanks to beloved family so the author is able to completed this thesis on predetermined time. This thesis was made to complete the requirement to finish study in Postgraduate Program of Business Information System Department, Gunadarma University. The title of this thesis is the "QUALITY MEASUREMENT OF TRANSPORTATION SERVICE APPLICATION USING ISO 25010 QUALITY MODEL (CASE STUDI: GO-JEK))"

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Author realizes that there are no perfect things in the world, same as this work which may has many mistakes. Therefore, Author still looking forward to get some criticism and suggestion from anyone to make this work better in the future. Hopefully, this work can bring some advantages to readers.

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Millati Izzatillah, S.Kom

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Chapter 1

INTRODUCTION

This chapter provides an overview of the issues raised in research conducted. Things discussed are the background research, identification of issues, scope of the study, statement of the problem, research objectives and research benefits.

1.1 Background

Gadget trend continues to grow in Indonesia. The sophistication of gadgets technology such as smartphones, computers, laptops and tablets is growing with the increasing of human needs of the modern media and practical. Gadget trend is supported by thousands of mobile applications that available on Google Play for Android operating system and the App Store for iOS operating system. Research results from Indonesia Growth for Knowledge (GfK) stated that mobile apps users are aged between 20 and 40 years of 68% the Indonesian society population [2]. Mobile based application covers the entire scope of human life, one of which is the transportation.

Transportation service application is an application that provides a variety of services to vehicle sharing system at a time and in a short time [6]. Transportation service application has been widely used by Indonesian society, Jakarta city and surrounding areas. The existence of transportation service application provides many benefits such as transportation costs tend to be cheaper, booking transportation service easily, efficient and fast.

Research results from Indonesia Growth for Knowledge (GfK), Robin Muliady said that the transportation service the most widely used application is the GO-JEK followed by Grab, Kereta Api Access, JNE and Uber. GO-JEK application users reached 21.6% of the total users of transportation service

application that used in Indonesia [22].

Use of GO-JEK application has a very high intensity when viewed from the total users. Beside that, GO-JEK also has 12 services include many functions that must running well. The services can be ordered by multiple users in the same time. Based on these conditions quality of GO-JEK application need to be measured that all functions running properly and correctly resulting in better application performance.

Software quality has many different definitions depending on who is defining. Software quality defined by the two sides, namely the producer side and the consumer side. Producer side is the quality of a software when the software was successfully developed in accordance with the specification requirements and agreement of stakeholders. For the consumer side defines the quality of a software when the software performs all functions properly and correctly, use or repeated over a long period of time. Besides the quality of software that is both easy to adjust to various devices, such as good design that maintain the integrity of the conceptual components of the product and reduce the coupling of different components[29].

Measuring the quality of transportation service GO-JEK application would be measured using ISO 25010 Quality Model. Characteristics to be tested from ISO 25010 Quality Model covers two dimensions, namely the Product quality and Quality in use. ISO 25010 Quality Model have been selected for based research [30] ISO 25010 Quality Model is the latest standard and relevant to test a mobile application replaces the previous standard ISO 9126 Quality Model, which since 2001 become a standard benchmark quality analysis software.

1.2 Problem Identification

Based on the background above, the author identifies the problems faced by the various parties involved like the developer, how to produce software with good quality in accordance with ISO 25010 Quality Model. While that faced by the user, how to determine the quality of the software used. This research, the author measure the quality of the transportation service application GO-JEK. Whether the application has a good quality in terms of functionality, performance, compatibility, usability, reliability, security, maintainability, portability, effectiveness, efficiency, satisfaction, freedom from risk, context coverage, so it really can help the user's activity in the process of

booking services on the application.

1.3 Scope of the Research

Based on the problem identification above, scope of the research as follows:

1. Measurement of software quality is the transportation service application GO-JEK.
2. Measurement of software quality is using a model of ISO 25010.
3. The population used in this research is GO-JEK users in Indonesia who have the educational Information Technology background.
4. Questionnaires filled out by 100 respondents using purposive sampling technique.
5. Samples are transportation services application GO-JEK users who have the educational Information Technology background and domicile in Jakarta and surrounding areas (Depok, Tangerang, Bekasi).

1.4 Statement of Problem

Based on the problem identification above, statement of problem as follows:

1. How to determine the relative weight characteristics and sub characteristics while measurement of software quality using ISO 25010 Quality Model?
2. How to know the characteristics and sub characteristics are to be used to measure the quality of transportation service application GO-JEK based on ISO 25010 Quality Model?
3. How to test the transportation service application GO-JEK from characteristics and sub characteristics ISO 25010 Quality Model to get quality value?
4. How to analyize data from the testing result of characteristics and sub characteristics ISO 25010 Quality Model?

1.5 Research Objective

The purpose of this research is to measure the Product Quality and Quality in Use of transportation service application GO-JEK using ISO 25010 Quality Model. Beside that, for proving whether the GO-JEK application already fulfil quality standard based on international standardization and see what characteristics influence the application with reference to ISO 25010 Quality Model, which is expected to provide information and guidance for developers transportation service application on the characteristics which must be considered in the development of mobile application transportation service.

1.6 Research Benefits

This research is expected to be beneficial for all parties, including the theoretically and practically benefits. The theoretical benefits that can be taken from this research is to the development of knowledge about application quality measurement using ISO 25010 Quality Model, especially in the transportation service application, can be further expanded.

As for the practically benefits which is expected to be beneficial to the Developer and User of this research are as follows:

1. For academics, this research can be used as a reference for measuring the quality of a mobile application, especially transportation service application.

2. For researchers, contributed to the development of the quality measurement of transportation services application literature in Indonesia.

3. For developer, the measurement quality result of transportation service application GO-JEK can provide feedback information on the response given by user. The feedback can be materials for improving of better performance in the application development . The feedback also can be a reference for other developers about characteristics that will become the benchmark from transportation service application quality.

4. For user, the measurement quality result of transportation service application GO-JEK can provide information that will be considered in using the application as needed.

Chapter 2

LITERATURE REVIEW

2.1 Development of Transportation Service Application

Various benefits are felt by the Jakarta society from transportation service applications such as transportation costs tend to be cheaper, booking transportation services easily, efficiently and quickly, making transportation service application is progressing very rapidly. Transportation service application is an application that provides vehicle sharing services at a time in a short time [6].

Transportation service application can be downloaded for free via a smartphone on Google Play for Android users or in the App Store for iPhone users. Transportation service application that is rated above 3.5 scale 5 is GO-JEK, GRAB, UBER and My Bluebird. As described in the previous chapter, the research results of Indonesia Growth for Knowledge (GfK), Robin Muliady stated that the transportation service application the most widely used is GO-JEK with total users reached 21.6% of total mobile applications used in Indonesia [22].

2.2 Transportation Services Application GO-JEK

GO-JEK is a company founded by Nadiem Makarim in June 2010. GO-JEK is a socially minded technology company that has purpose to improve the welfare of workers in a variety of informal sector in Indonesia. GO-JEK partner about 200.000 motorcycle riders who are experienced and trusted in Indonesia, to provide various services, including transport and home deliv-

ery of food. GO-JEK has officially operates in 10 major cities in Indonesia, including Jakarta, Bandung, Bali, Surabaya, Makassar, Yogyakarta, Medan, Semarang, Palembang and Balikpapan with development plans in other cities in the coming year [1].

GO-JEK activity focus on three fundamental values: speed, innovation, and social impact. The GO-JEK driver said that their income increased since joining as a partner, they also get health and accident compensation, and gain access to more customers through the application of GO-JEK. GO-JEK logo can be seen in Figure 2.1 [1].

Figure 2.1: GO-JEK Logo [1]

GO-JEK has some services that can be seen in figure 2.2 and will explain on table 2.1 [1].

Figure 2.2: GO-JEK Services [1]

Table 2.1: GO-JEK Services [1]

Services	Description
GO-RIDE	GO-RIDE is a motorcycle transportation services that can bring user to various places, easier and faster.
GO-CAR	GO-CAR is a car transportation service that can bring user to various place comfortably.
GO-FOOD	GO-FOOD is the number one delivery food service in Indonesia that has more than 30.000 restaurant list.
GO-SEND	GO-SEND is an instant courier service that can be used to send mail and goods within 60 minutes.
GO-MART	GO-MART is a service that can be used to shop thousands of goods from various shops.
GO-BOX	GO-BOX is a service to move goods using a full size truck / van blind.
GO-MASSAGE	GO-MASSAGE is a massage services of health professionals who come to the house.
GO-CLEAN	GO-CLEAN is a cleaning service with professional cleaner to clean dorm room, home and office.
GO-GLAM	GO-GLAM is a beauty treatment services with a profesional beautician for a manicure-pedicure, cream bath, waxing, and others who came to the house.
GO-TIX	GO-TIX is an information service with access event ticket purchase and delivery directly into the user hands.
GO-BUSWAY	GO-BUSWAY is a monitoring bus schedule service the TransJakarta and ordered GO-RIDE to deliver user to the selected bus stop.
GO-PAY	GO-PAY is a virtual wallet service for GO-JEK user transactions in the application GO-JEK that can be recharged via ATM, M-Banking or Internet Banking BCA, BRI and Mandiri.

Measuring the quality of GO-JEK application will use version 2.5 in the last update on August 30, 2016. In this version, GO-JEK home screen has a user interface that is easy to access all the services GO-JEK. For service GO-RIDE, GO-FOOD and GO-MART was renewed appearance. GO-TIX introduce event categories with better discovery features and hot deals. GO-JEK has provided a feature GO-PAY, so users can easily perform non-cash payment for all services GO-JEK with the top up at an ATM, the M-Banking or Internet Banking BCA, BRI, Mandiri, CIMB Niaga and Prima Network. Beside that, GO-JEK provide new services that GO-CAR where users can book a private car is the same function as the GO-RIDE[3].

2.3 Software Quality Assurance (SQA)

According to IEEE Glossary, Software Quality Assurance (SQA) a planned and systematic pattern needed to ensure products in accordance with the technical requirements that have been set. Software Quality Assurance (SQA) is also a series of evaluation activities designed to develop or produce a product. SQA is based on the planning and implementation of various actions are integrated into all phases of the software development process. This is done to support the confidence of users that the software product will fulfill all technical requirements. Although the planning and implementation of systematic, the scope of the SQA excluding maintenance, schedule, and budget issues. SQA Definition expanded in accordance with the basic concepts of the standards of quality of existing models [11].

SQA activity refers to functional aspects, managerial, and economics in the development and maintenance of software. This activity is done to prevent, detect, and correct the cause of the error. The purpose of the activities SQA seen from the following aspects [11].

1. Software Development (Process-Oriented):
    - Ensure an acceptable level of confidence that the software will be in accordance with the ffunctional technical requirements.
    - Ensure an acceptable level of confidence that the software would be suitable for managerial scheduling and budget requirements.
    - Initiate and manage activities for the improvement and efficiency of software development. This can improve the prospects of functional and managerial needs to be achieved as well as reduce the cost of software development and SQA activities.
2. Software Maintenance (Product-Oriented):
    - Ensure the acceptable level of confidence that the software maintenance activities will be in accordance with the functional technical requirements.
    - Ensure the acceptable level of confidence that the software maintenance activities will be in accordance with the scheduling of managerial and budgetary needs.
    - Initiate and manage activities to improve and enhance the efficiency of maintenance of software and SQA activities. This can

increase the prospect of achieving a functional and managerial needs and reduce costs.

2.4 Quality Models

Software Quality Assurance (SQA) has several options-quality models that can be used to measure software quality assurance. Typically, software quality have been identified as follows [21]:

1. Compliance with Specification: Quality is defined as the product and services that are measurable, and characteristics that have determined specification.

2. User Requirement: Quality is identified irrespective of measurable characteristics. It defines quality as the ability of a product or service to fulfil customer expectations explicitly or not.

Quality model that has international standardization can be trusted reference while measuring software quality. International quality models that often used are McCall's Quality Model (1977), Boehm's Quality Model (1978), dan ISO 9126's Quality Model (2001) [21]:

2.4.1 McCall's Quality Model

Founder of the quality model that is still famous of the current quality model is a model of quality delivered by Jim McCall (also known as General Electrics Model of 1977). McCall Quality Model attempts to bridge the gap between users and developers to focus on a number of factors to the views of users of software quality and developer priorities. This model comes from the US military (developed for the US Air Force, was promoted in DoD) and addressed to the system developers and system development process [21].

McCall's Quality Model has three main perspectives to define and identify the quality of software products, including a revision of the product, the product transition, and operations products. Revised product is the ability to change, the transition of products is the ability to adapt to new environments, and operation of the product is the ability to operate the product. Revision products include maintainability, flexibility and testability. Transition products include matters pertaining to portability, reusability and in-

teroperability. While the quality of product operations related to the truth correctness, reliability, efficiency, integrity and usability[21].

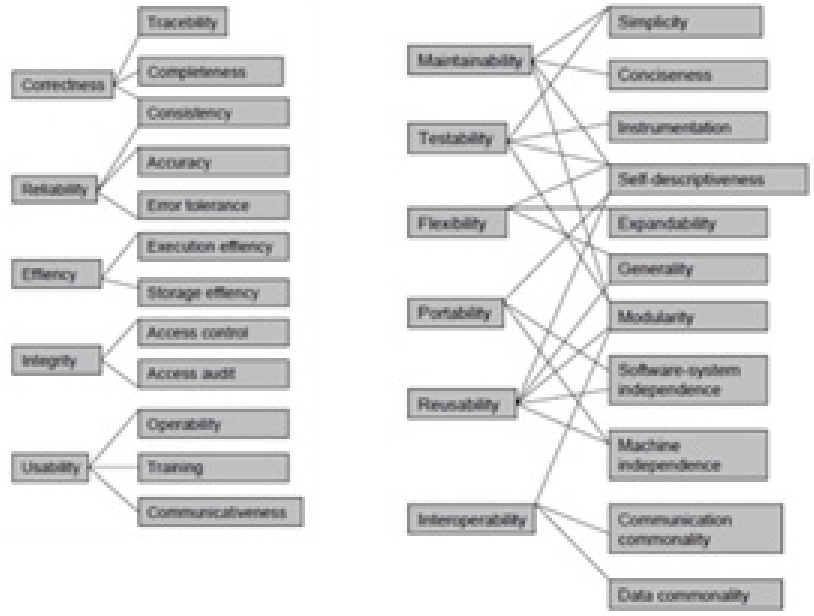


Figure 2.3: McCall's Quality Model [21]

On McCall's Quality Model, as shown in Figure 2.4, three types of quality characteristics (main perspectives) specified in the hierarchy of factors, criteria and metrics as follows [21]:

1. 11 factors (to decide): Describing the external view of the software, as seen by the user.
2. 23 quality criteria (for building): Describing the internal view of the software, as seen by the developer.
3. Metric (to control): Defined and used to provide a scale and method for measurement.

McCall's Quality Model in Figure 2.4 explained that the hierarchy 11 quality factors are on the left side and 23 quality criteria on the right side. The idea behind the McCall's Quality Model is the quality factor are required to provide complete software quality [21].

2.4.2 Boehm's Quality Model

Boehm's Quality Model is a model of quality delivered in 1978 by Barry W. Boehm to discuss the shortcomings of contemporary models automat-

ically and quantitatively evaluate the quality of software. Boehm Quality Model Quality Model McCall similar to a structured hierarchy. In essence, this model tries to determine the quality of the software is based on the set of attributes and metrics[21]. Boehm's Quality Model can be seen in Figure 2.5.

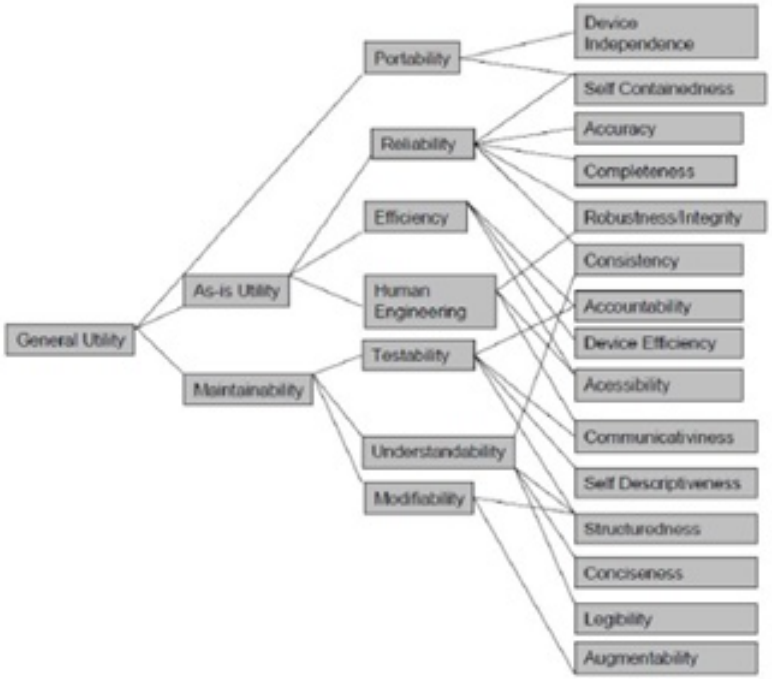


Figure 2.4: Boehm's Quality Model [21]

Model hierarchical structure shown in Figure 2.4 has the characteristic levels ranging from high to low-level characteristics. Characteristics of a high level is a basic high-level requirements on the actual use that evaluates the quality of the software. Characteristics of high-level addresses three main questions that are usually filed by a buyer of the software, as follows[21]:

1. As-is Utility: How good (easy, reliable, efficient) this software can I use?

2. Maintainability: How easy to understand, modify and retest?

3. Portability: Can I still use it if I change my environment?

Mid-level characteristics have seven Boehm quality factor representing the expected quality of a software system. Seventh Boehm's Quality Model factor is as follows [21]:

1. Portability (General utility characteristics): The code that has the characteristics of portability to the extent that can be operated easily and well on any other computer configurations of the current configuration.

2. Kehandalan (As-is utility characteristics): The code that has the characteristics of reliability to the extent that can be expected in performing its functions.

3. Efisiensi (As-is utility characteristics): The code that has the characteristics of efficiency to the limit to meet its objectives without waste of resources.

4. Kegunaan (As-is utility characteristics, Human engineering): The code that has the characteristics of usability to the extent that a reliable, efficient, and human-engineered.

5. Testability (Maintainability characteristics): The code that has the characteristics of testability to the extent that can facilitate the formation of the verification criteria and support the evaluation of its performance.

6. Understandability (Maintainability characteristics): The code that has the characteristics of mutual understanding to the extent that the goal is clear to inspectors.

7. Flexibility (Maintainability characteristics, Modifiability): The code has the characteristic modifiability to the extent that facilitate the incorporation of changes after the nature of the desired changes have been determined.

Lowest level characteristics of hierarchy in the Boehm's Quality Model is a hierarchy of metrics primitive characteristics. Primitive characteristics provide the basis for determining the quality metric which is one of the achievements while building Boehm Quality Model. Although Boehm and McCall have similarities, Boehm model focused more on cost-effectiveness of software maintenance[21].

2.4.3 ISO 9126's Quality Model

International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC) has set the standard ISO/IEC related to

software quality. First ISO is ISO 9000 which has three guidelines for implementing ISO 9001 standards relating to quality assurance processes. This process is done for the development, supply, installation, and maintenance of computer software.

Then, the standard ISO / IEC 9126 is set for the quality of software products and standard ISO / IEC 14 598 for the evaluation of software products. Other standards that can be used in conjunction with ISO / IEC 9126 and ISO / IEC 14 598 are as follows [7]:

1. ISO/IEC 12119 - The quality requirements for a software package.
2. ISO/IEC 12207 - Software life cycle processes.
3. ISO/IEC 14143 - Measurement software.
4. ISO/IEC 15271 - Guide for ISO / IEC 12207.
5. ISO/IEC 15504 - Software process assessment (also known as SPICE - Software Process Improvement Capability for Determination).
6. ISO/IEC 15939 - Software measurement process.

Standard ISO / IEC 9126 makes a distinction between internal quality and external quality. This model categorizes software quality attributes into characteristics. Attributes that can be measured during the development process is referred to as internal. Meanwhile, the external behavior can be measured during the testing process and the quality of the views of users [7]. ISO / IEC 9126 consists of four sections which include ISO 9126-1 Quality Model, Metrics External ISO 9126-2, ISO 9126-3 Internal Metrics, and ISO 9126-4 Quality in Use Metrics [21].

ISO 9126-1 quality model defined by the general characteristics of the software, which is further refined into subcharacteristics, which in turn decomposed into attributes and generate a multilevel hierarchy. The main idea behind this standard is the definition of quality model and its use as a framework for the evaluation of the software. At ISO 9126-1 Quality Model 2001 version contained six and 27 subkarakteristik characteristics outlined in Table 2.2. [7].

Table 2.2: ISO 9126-1 Quality Model [7]

Characteristics	Subcharacteristics
Functionality	Suitability
	Accuracy
	Interoperability
	Security
	Functional Compliance
Reliability	Maturity
	Fault Tolerance
	Recoverability
	Reliability Compliance
Usability	Understandability
	Learnability
	Operability
	Attractiveness
	Usability Compliance
Effeciency	Time Behavior
	Resource Utilization
	Effeciency Compliance
Maintainability	Analysability
	Changeability
	Stability
	Testability
	Maintainabiliy Compliance
Portability	Adaptability
	Installability
	Coexsistence
	Replaceability
	Portability Compliance

In this 2001 version are the addition of Compliance in each characteristic subkarakteristik ISO 9126-1 Quality Model. A detailed description sixth ISO 9126-1 Quality Model characteristics are as follows:

1. Functionality: The ability of the software to provide the functions according to user needs when used under certain conditions.

2. Reliability: The ability of the software to maintain the level of performance when used under certain conditions.

3. Usability: The ability of the software associated with the use of software made by the user.

4. Efficiency: The ability of the software to provide an appropriate level

of performance and the amount of resources used when the software is run.

5. Maintainability: The ability of the software associated with the effort required to be modified or changed.

6. Portability: The ability of the software to be sent to a different environment or one environment to another.

2.4.4 ISO 25010 Quality Model

ISO / IEC 25010: 2010 (ISO 25010), is part of a series known as Software Quality Requirements and Evaluation (SQuaRE), defines the quality system as "the degree to the which the system satisfies the stated and implied needs of its various stakeholders, and Thus Spake Provides value"[20].

ISO 25010 is an extension of ISO 9126. ISO 25010 has two main dimensions: Product Quality and Quality-in-use (QinU). Dimension Product Quality consists of eight quality characteristics, namely Funtional suitability, efficiency Performance, Compatibility, Usability, Reliability, Security, Maintainability and Portability. Figure 2.5 outlines the characteristics and sub characteristics on dimensions of Product Quality [19].

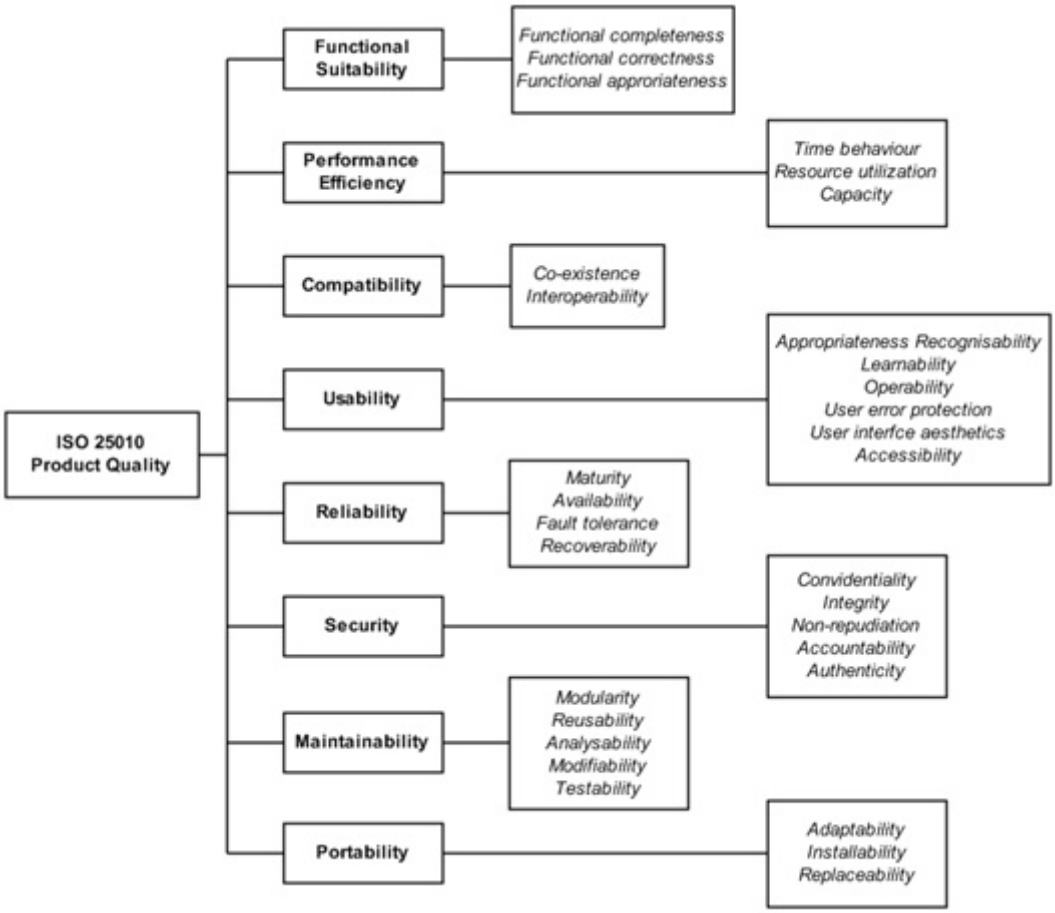


Figure 2.5: ISO 25010 Product Quality Dimension

The definition of each characteristic can be seen in Table 2.3 below.

Table 2.3: Product Quality Characteristics

No	Characteristic	Sub Characteristic	Description
1	Functional Suitability: Degree to which a product or system provides functions that meet stated and implied needs when used under specified conditions.	1.1 Functional Completeness	The ability of applications to fulfil the complete functions.
		1.2 Functional Correctness	The ability of applications to deliver the correct results in accordance with the necessary requirements.
		1.3 Functional Appropriateness	The ability of applications to deliver the appropriate results.

No	Characteristic	Sub Characteristic	Description
2	Performance Efficiency: Represents the performance relative to the amount of resources used under stated conditions.	2.1 Time Behaviour	The ability of an application to manage time and provide a response when the application is used.
		2.2 Resource Utilization	The ability of applications in processing resources when the application is used.
		2.3 Capacity	The ability of applications to provide maximum limit on the use of the application.
3	Compatibility: Degree to which a product, system or component can exchange information with other products, systems or components, and/or perform its required functions, while sharing the same hardware or software environment.	3.1 Co-existence	The ability of the application to perform the functions necessary to efficiently and be able to share the environment with other applications or systems.
		3.2 Interoperability	The ability of the application to exchange information and use the information that has been exchanged.
4	Usability: Degree to which a product or system can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use.	4.1 Appropriateness Recognizability	The ability of the application to provide product introduction in accordance with user needs.
		4.2 Learnability	The ability of the application to provide convenience for the user to learn.
		4.3 Operability	The ability of the application to provide convenience for the user to operate.
		4.4 User Error Protection	The ability of an application to protect users from making mistakes.

No	Characteristic	Sub Characteristic	Description
		4.5 User Interface Aesthetic	The ability of applications to give users a pleasant user interface.
		4.6 Accessability	The ability of an application to be used by people with a wide range of characteristics and the ability to achieve a certain goal in the context of a particular use.
5	Reliability: Degree to which a system, product or component performs specified functions under specified conditions for a specified period of time.	5.1 Maturity	The ability of the software associated with the frequency of errors in software failure.
		5.2 Availability	The ability of the application to be accessible when required for use.
		5.3 Fault Tolerance	The ability of the application to maintain its performance level in case of software errors or violations specified interface.
		5.4 Recoverability	The ability of the application to rebuild the level of performance and recover the data directly affected in case of system failure, including data and network connections.
6	Security:	6.1 Confidentiality	The ability of the application to be able to ensure that data is accessible only to those authorized and has an access.

No	Characteristic	Sub Characteristic	Description
	Degree to which a product or system protects information and data so that persons or other products or systems have the degree of data access appropriate to their types and levels of authorization.	6.2 Integrity	The ability of an application to prevent unauthorized access to get into the system.
		6.3 Non-repudiation	The ability of the application can detect actions or events that have occurred, and provide evidence that the transaction has been made user.
		6.4 Accountability	The ability of the application to track all application activity or activities performed by the user in the application.
		6.5 Authenticity	The ability of the application to provide evidence or authenticity of user data.
7	Maintainability: Degree of effectiveness and efficiency with which a product or system can be modified to omporve it, correct it or adapt it to changes in environment, and in requirement.	7.1 Modularity	The ability of an application to set a minimal impact on the change of the separate components.
		7.2 Reusability	The ability of the application can be used on more than one system or can build other assets.
		7.3 Analysability	The ability of the application in diagnosing deficiencies or causes of failures and identify the parts to be changed.
		7.4 Modifiability	The ability of applications to modificate without decreasing application quality effectively and efficiency.
		7.5 Testability	The ability of the application to test determine the required criteria.

No	Characteristic	Sub Characteristic	Description
8	Portability:	8.1 Adaptability	The ability of the applications to adapt on devices or vary environments .
	Degree of effectiveness and efficiency with which a system, pproduct or	8.2 Installability	The ability of the application to be installed or removed in any other device or a particular environment.
	component can be transferred from one hardware, software or other operational or usage environment to another.	8.3 Replaceability	The ability of the application to be used as a substitute for similar applications.

Quality-in-use (QinU) defines the characteristics related to the human interaction with the system, while product quality defines the basic characteristics of a product. QinU defined as capability of a software product to influence users effectiveness, productivity, safety and satisfaction to satisfy their actual needs when using the software product to achieve their goals in a specified context of use [19].

QinU Model consists of five characteristics: effecticeness, efficiency, satisfaction, freedom from risk and context coverage. Figure 2.6 outlines the characteristics and sub-characteristics that are contained in the dimension QinU [20].

Figure 2.6: ISO 25010 Quality in Use Dimension

The definition of each characteristic can be seen in Table 2.4 below.

Table 2.4: Quality in Use Characteristics

No	Characteristic	Sub Characteristic	Description
1	Effectiveness:		The ability of an application in terms of accuracy and completeness for purposes of users achieve certain goals.
2	Efficiency:		The ability of an application to manage the energy expended by the user when using the application.

No	Characteristic	Sub Characteristic	Description
3	Satisfaction: Degree to which user needs are satisfied when a product or system is used in a specified context of use.	3.1 Usefulness	The ability of the application to provide benefits to the user when used.
		3.2 Trust	The ability of applications can provide confidence to the user that the application can be used as its function.
		3.3 Pleasure	The ability of the application to provide the pleasure of fulfil the users needs.
		3.4 Comfort	The ability of the user application can create content with the physical comfort.
4	Freedom from risk: Degree to which a product or system mitigates the potential risk to economic status, human life, health, or the environment.	4.1 Economic risk mitigation	The ability of applications reduces the potential risks to the financial status, or resources in the context of the intended user.
		4.2 Health and safety risk mitigation	The ability of applications reduces the potential risks for people in the context of the intended users.
		4.3 Environmental risk mitigation	The ability of applications reduces the potential risk to property or the environment in the context of the intended users.
5	Context coverage:	4.4 Context completeness	The ability of the application to be used effectively, efficiently, free from risk and give satisfaction in the entire context of use.

No	Characteristic	Sub Characteristic	Description
	Degree to which a product or system can be used with effectiveness, efficiency, freedom from risk and satisfaction in both specified contexts of use and in contexts beyond those initially explicitly identified.	4.5 Flexibility	The ability of the application to be used effectively, efficiently, free from risk and give satisfaction in the specific context needed.

2.4.5 Comparison of Quality Model

Comparison of McCall's, Boehm's, ISO 9126 and ISO 25010 quality models based on the characteristics set out in the table 2.5.

Table 2.5: Comparison of Quality Model

No	Quality factor	Mc Call (1977)	Boehm (1978)	ISO 9126 (2000)	ISO 25010 (2010)
1	Accuracy	-	-	X	X
2	Adaptability	-	-	-	X
3	Analyzability	-	-	X	X
4	Attractiveness	-	-	X	X
5	Changeability	-	-	X	X
6	Correctness	X	-	-	X
7	Efficiency	X	X	X	X
8	Flexibility	X	-	-	-
9	Functionality	-	-	X	X
10	Human Engineering	-	X	-	-
11	Installability	-	-	X	X
12	Integrity	X	-	-	X
13	Interoperability	X	-	-	X
14	Maintainability	X	-	X	X
15	Maturity	-	-	X	X
16	Modifiability	-	-	-	X
17	Operability	-	-	X	X
18	Performance	-	-	X	X
19	Portability	X	X	X	X
20	Reliability	X	X	X	X

No	Quality factor	Mc Call (1977)	Boehm (1978)	ISO 9126 (2000)	ISO 25010 (2010)
21	Resource Utilization	-	-	X	X
22	Reusability	X	-	-	X
23	Stability	-	-	X	X
24	Suitability	-	-	X	X
25	Supportability	-	-	X	X
26	Testability	X	X	X	X
27	Transferability	-	-	-	X
28	Understandability	-	X	X	X
29	Usability	X	-	X	X

Based on Table 2.5 ISO 25010 Quality Model has the most complete characteristics than the other quality models because there are 26 of the 28 factors. From this comparison, efficiency, portability and reliability are characteristics of the quality that appears in all models. ISO 25010 Quality Model is a improvement of the ISO 9126 Quality Model. According to research [7], ISO 9126 has some limitations because its generic nature. Some of the concepts presented by ISO 9126 need to be refined before it is applied completely within a project. In addition, elements of metrics software is not clear when defining the standard [9].

The new characteristics have been included in ISO 25010 is security and compatibility. Both of these characteristics are not presented in ISO 9126. Beside that, hierarchy of characteristics and sub characteristics in restructure with the purpose to improve the understanding of related concepts. This is done to overcome the limitations of ISO 9126 in connection with the generic nature, incompleteness and vagueness as described by researcher.[5].

Other reason the ISO 9126 Quality Model is not relevant to be the standard in software testing because ICT (Information Communication and Technology) change very quickly and very different from a decade ago. Evolution in the world of ICT such as more memory usage, a better display and a faster processor enables the development of new application systems that also require different quality measurement like using ISO 25010 Quality Model [30]. Based on data from the research and comparison of quality models, this research uses ISO 25010 Qualty Model to measure the quality of transportation service aplication the most widely used by Indonesian society and the highest number of downloading, namely GO-JEK.

2.5 Statistical Product and Service Solutions (SPSS)

SPSS Statistics is a comprehensive system for analyzing data. SPSS Statistics can retrieve data from almost any type of file. The data is used to generate reports, graphs, and trends in distribution, descriptive statistics, and complex statistical analysis. SPSS Statistics ownership is held by International Business Machines (IBM) Corporation. There are several types of window that is commonly used in all versions of SPSS Statistics, as follows [17]:

1. Data Editor: display the contents of the file data. Users can create new data files or modify existing data files in the Data Editor.

2. Viewer: all the statistical results, tables, and graphs displayed in the Viewer. Users can edit the output and save it for later use. Viewer window opens automatically the first time users run a procedure that generates output.

3. Pivot Table Editor: the output is displayed in pivot tables can be modified in various ways using the Pivot Table Editor. Users can edit text, data swap rows and columns, add color, create multidimensional tables, and selectively hide and show results.

4. Chart Editor: users can modify high-resolution charts and plots in the graph window. Users can change the color, select the font type or size are different, switching from horizontal and vertical axes, rotate 3-D scatterplots, and change the chart type.

5. Text Output Editor: text output is not displayed in pivot tables can be modified with the Text Output Editor. Users can edit the output and change font characteristics (type, style, color, size).

6. Syntax Editor: the user can insert selection dialog box to Syntax window, where the user's choice appears in the form of command syntax. Users can then edit the command syntax to use special features that are not available through dialog boxes. In addition, users can also save commands in the file to be used at the next session.

In this study, SPSS is used SPSS version 23 for test validity and reliability of the results of questionnaires filled out by several respondents. SPSS 23

is the latest version that was released in 2015. In this version there are some improvements and increased keampuan SPSS in collecting data, data analysis, predict, and make decisions[17].

2.6 Previous Researches

One of step in the study literature process is collect the related research that discuss the same theme. Related research can be a reference of the research to be conducted. Related research is taken by journal about the standardization of quality measurement ISO 25010 Quality Model with their respective advantages and disadvantages described in the following table.

Table 2.6: Summary of Previous Researches

No	Journal	Authors	Strength	Weakness
1	SOAQM: Quality model for SOA applications based on ISO 25010 [10]	Joyce M. S. Franca and Michel S Soares	The purpose of this research is successful, that is to find out what attributes in accordance with SOA application based on ISO 25010 Quality Model	There are generic nature of ISO 25010 is not applicable for SOA domain. Beside that, the number of respondents only 7 people, then there is a threat to the validity.
2	Measuring Public Value UX based on ISO/IEC 25010 Quality Attributes [26]	Ashok Sivaji, Noor-farhana Abdollah, Soo Shi Tzuaan, Siti Hamimah Rasidi and Yoong SIew Wai	The purpose of this research is successful, which measures the value of user experience using job-seeking websites created by the Malaysian government. Explanation of measured results qualitatively are good enough, so the quality of the e-government can be seen clearly. Methods of measurements taken are considered appropriate in this research, that is to measure the quality objectively.	The research is limited to the characteristics usability and Quality in Use dimension. beside that, the sample used in this research is only 23 graduates, so the result is not considered to represent the population to measure website fresh graduate job-seeking e-government of Malaysia.

No	Journal	Authors	Strength	Weakness
3	Assessing the Quality of M-Learning Systems using ISO/IEC 25010 [4]	Anal Acharya and Devadatta Sinha	This research is quite good and detail, because the author adjust the characteristics in accordance with the M-Learning system and then perform the measurement. Measuring the quality of M-Learning is done using metrics illustrated with numbers, so it's easy to see the value of quality M-Learning system.	The purpose of this research did not get the expected results, ISO 25010 is considered not suitable for measuring the quality of M-Learning because it can not measure the characteristics of learning such as effectiveness of the learning objects in the context of the learner, personalized and collaborative learning and learning outcomes.
4	Applying ISO/IEC 25010 on Mobile Personal Health Records [23]	Sofia Ouhbi, Ali Idri, Jos´e Luis Fern´andez-Alem´an, Ambrosio Toval and Halima Benjelloun	The purpose of this research is successful, that is to identify any requirements in evaluating the quality of a software product mPHR system (Mobile Personal Health Record) and to evaluate the extent of influence mPHR requirements on the characteristics of software product quality using ISO / IEC 25010. The results of this research also useful for giving an overview and evaluation of the system mPHR to serve as a reference for stackholders, developers and evluators.	In this research, measurements were performed still by combining some ISO quality models, so it is not only use ISO 25010. Besides that, the possibility still exists requirement relating mPHR in this research but has not been included in the list of requirements.

No	Journal	Authors	Strength	Weakness
5	An Application of The ISO/IEC 25010 Standard in The QUALITY-IN-USE Assesment of An Online Health Awareness System [15]	Azham Hussain and Emmanuel O.C. Mkpojiogu	Stages of quality measurements conducted at the research concise and clear. Measurements were made with usability testing, attitudinal questionnaires and observation. Users of e-Ebola Awareness System is given four tasks to be done and completed. Overall, the value of satisfaction on e-Ebola Awareness System is good, ie 67.50.	The authors explain that the research only measures the Quality in use in e-Ebola Awareness System, the characteristics of which measured less in accordance with the characteristics of Quality in use is based on the ISO 25010 Quality in Use.

Chapter 3

RESEARCH METHODOLOGY

Chapter 3 in this thesis is the research methodology from this research. In this chapter there are a research object, population and sample of research, data collection methods, research instruments and data analysis methods with each testing method and analysis which will be explained in more detail in the discussion below.

3.1 Research Object

Object used in this research is the most populer transportation service application in Indonesia, GO-JEK. Accordance Robin Muliady, Media Director Consumer Choices Growth for Knowledge (GfK) Indonesia said, GO-JEK is the most widely used mobile application in Indonesia reached 21.6% from all mobile application usage in Indonesia. While the competitors, GRAB reached 6.4% [22].

This research used GO-JEK application on version 2.4 wih minimum Android 4.0 operating system for android user and minimum iOS 7.0 for iphone and ipad user

3.2 Population and Sample

Population is all part or member of the objects to be observed [8]. The population used in this research is the transportation service application GO-JEK in Indonesia. The purpose of this research to measure the quality of traansportation service application GO-JEK. Therefore the users who will be the target population is the users who have knowledge of quality measurement, that is users have Information Technology educational background

such as developers, graduates S.Kom and S.T or students Majoring Information Technology.

After determining the target population, researchers create a sample frame that aims to ensure all members of the population has an equal opportunity to be sample[8].

Table 3.1: Sample Structure

Target population	Sample Structure	Access
All GO-JEK users in Indonesia which has the Information Technology educational background.	List usernames GO-JEK who holds S.Kom and S.T	Arranged by author
	List usernames GO-JEK who is a graduate student majoring in IT.	
	List usernames GO-JEK who works as a software developer	

Sampling Technique used in this research is purposive sampling techniques. Purposive sampling techniques is the development of random sampling that is based on certain considerations of researcher.[8]. Considerations in this research make samples to be taken must fulfill the following criteria.

1. Sample is transportation service GO-JEK user that have educational background of Information Technology so they can measure the quality of the application objectively.

2. Sample is transportation application GO-JEK user that domiciled in Jakarta and surrounding areas (Depok, Tangerang, Bekasi). It was chosen because of Jakarta and its surroundings is the largest number of GO-JEK user among another city such as Bandung, Bali, Surabaya and Makassar. Therefore, the samples taken in Jakarta and surrounding areas considered to represent the population of GO-JEK users in Indonesia.

The results of the research Growth for Knowledge Indonesia (GfK) stating that mobile apps users are aged between 20 and 40 years of 68% of the population [2]. Based on data from Badan Pusat Statistik that have been processed by Pusat Data dan Teknologi Informasi (Pusdatin), Indonesia's population aged 20 to 40 years amounted to 82,313,578 million. 20-40 age range chosen because at that age have the highest productivity and mobility in using smarthphone. From these data, can be obtained total mobile application users in Indonesia with the following calculation.

$$\begin{aligned}\text{TotUserMobileAppsInd} &= \text{PrsntaseUserMobileAppsInd } x \text{ TotPendudukInd} \\ &= 68\% \quad x \quad 82,313,578 \text{ Million} \\ &= 55,973,233 \text{ Million}\end{aligned} \tag{3.2.1}$$

Figure 3.1 shows the percentage of using transportation service application in Indonesia. Applications that have the largest of users is the GO-JEK with the percentage 21.6% of the total users of mobile application in Indonesia. The image can be seen below.

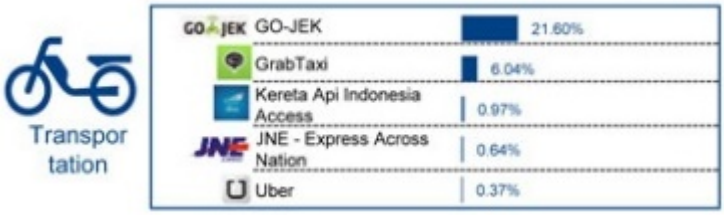


Figure 3.1: Percentage of Using Transportation Service Application

GO-JEK users in Indonesia reached 21.6%. This data can be used to find the total GO-JEK user in Indonesia from the total mobile application users in Indonesia. GO-JEK users in Indonesia can be seen in the calculation below.

$$\begin{aligned}\text{UserGO-JEKInd} &= \text{PrsntaseUserGO-JEKInd } x \text{ TotUserMobileAppsInd} \\ &= 21,6\% \quad x \quad 55,973,233 \text{ Million} \\ &= 12,090,218 \text{ Million}\end{aligned} \tag{3.2.2}$$

Calculation of total GO-JEK users in Indonesia above can be a population size that will be used to determine the number of samples. The sample is required to be respondents who will fill out a questionnaire quality of transportation service application GO-JEK to the characteristics Usability in Product Quality dimension and all the characteristics in Quality In Use dimension. Determination of the number of these samples using the formula size Slovin by the following equation:

$$n = \frac{N}{(N + \alpha^2) + 1} \tag{3.2.3}$$

Where:

n : Sample Size
N : Population Size
α: A Margin of Errorr ($\alpha = 0.1$)

Discovered Population Size (N) is $12,090,218$ and A Margin of Errorr ($\alpha = 0.1$), then Sample Size (n) as follows.

$$n = \frac{N}{(N + \alpha^2) + 1} = \frac{12,090,218}{\left(12,090,218 + (0.1)^2\right) + 1} = 99.99917289 \approx 100$$

Sample size calculation with Slovin formula obtained 100 respondents who are have Information Technology educational background and domicile in Jakarta and surrounding areas (Depok, Tangerang, Bekasi) with a confidence level of 90%.

3.3 Data Collecting Method

Data collecting technic in this research uses various technics. Technic that is used to collect data as following:

3.3.1 Literature Study

Literature Study used to obtain relative weighting characteristics and sub characteristics in ISO 25010 Quality Model using Luis Ricardo CORRAL VELÁZQUEZ research [31] in his dissertation entitled "A Software Assurance Model for Mobile Application". Weighting on the characteristics and sub characteristics of ISO 25010 Quality Model is made to provide rankings on the characteristics and sub characteristics from highest to lowest relative weight and the weight value will be used in the calculation process of transportation service application quality. Beside that, literature study is also used as a reference for making instruments and indicators of measurement.

Literature Study also used to understand the theories related to the Software Quality Assurance (SQA) and testing technique obtained from scientific journals, books, thesis, internet, and articles relating to research.

3.3.2 Observation

Observations on this research used to test the quality of a transportation service application on characteristics Functional Suitability, Performance Efficiency, Reliability, Compatibility and Security. The observations were made by author to directly observe the application to be tested by creating a test case for each sub characteristics on ISO 25010 Quality Model using black box testing.

3.3.3 Questionnaire

A questionnaire used to measure the characteristics Usability on Product Quality dimension and all characteristics on Quality in Use such as Satisfaction, Effectiveness, Freedom from risk, Efficiency, and Context coverage. Dissemination of questionnaire was conducted online using google form and take the respondents as many as 100 people from Jakarta, Depok, Tangerang and Bekasi. The questionnaire in this research adopts USE Qestionnaire of Lund, A.M. (2001) with a measurement scale for alternative answers using a Likert scale, scale interpretation can be seen in the following table.

Table 3.2: Likert Scale Interpretation

Scale	Interpretation	
1	STS	Strongly Disagree
2	TS	Disagree
3	N	Impartial
4	S	Agree
5	SS	StronglyAgree

3.4 Research Methodology

Testing the quality of transportation service application GO-JEK has several steps that must be done. Stages are included in Figure 3.2 As follows.

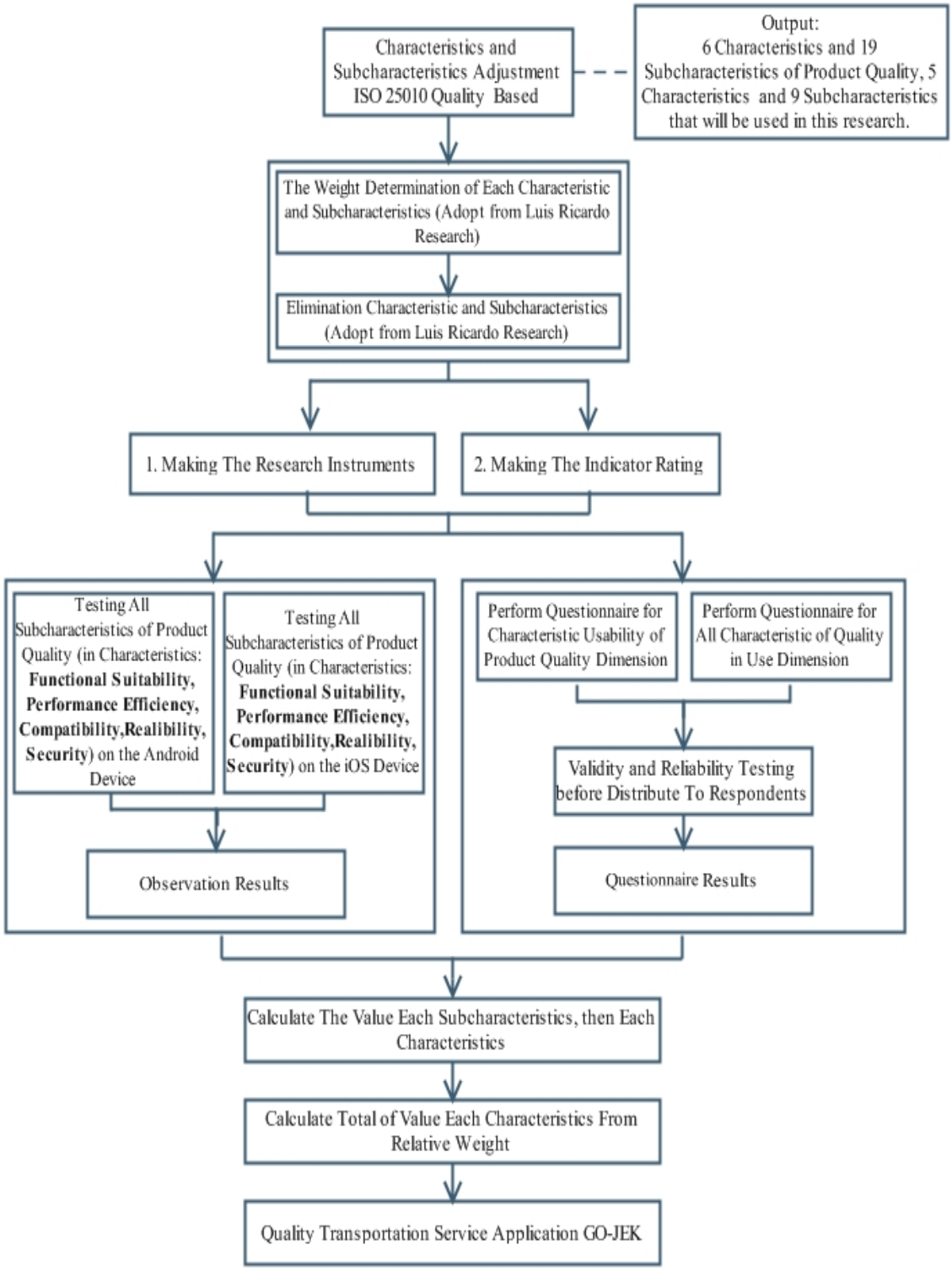


Figure 3.2: Research Methodology

3.4.1 ISO 25010 Quality Model Adjustment

The first step in this research is to adjust the model of ISO 25010. ISO 25010 Quality Model is divided into two-dimensional measurements those are Product Quality dimension and Quality in Use dimension. On the roduct Quality dimension there are 8 characteristics and 31 sub characteristics and the Quality in Use dimension are 5 characteristics and 11 sub characteristics [20].

Adjustment ISO 25010 Quality Model is done by giving weight to each of the characteristics and sub characteristics ISO 25010 Quality Model. Weighting methode in this research was adopted from research Luis Ricardo CORRAL VELÁZQUEZ, entitled A Software Assurance Model for Mobile Applications. Luis getting the weighting through several phases that will be explained as follows [31].

1. Describe the quality needs of mobile application store and characteristics of ISO 25010 Quality Model as well as the relationship between them with Quality Function Deployment (QFD). QFD helps to save design and development time, but more importantly it focuses on the satisfaction of end users.

2. Then identify the requirements to the characteristics of a quality standard ISO / IEC 25010. In those research, the terms of quality were taken by publishing guidelines drawn from six major applications stores, namely Google Play, Amazon Appstore, Nook Apps, IOS App Store, Windows Phone Store and Blackberry Wolrd.

3. Make Relationship Matrix to determine the interaction between Demanded Quality and Quality Characteristic.

4. Calculating Quality Characteristic Relative Weight that will indicate the weight of each sub characteristics.

5. Determine the priority of the entire sub characteristics by weight in descending order to see the most important characteristics in mobile apps.

The next on QFD implementation, to ensure a level of accuracy, research [31] developed in collaboration with the group by 2 professors software engineering specialized, 2 graduate students who conduct research in the mobile software engineering, a senior specialist software engineering of the Italian

army and 3 staff members of the third software company specialized in application development mobile.

The research states the relatives weight of each sub characteristics ISO 25010 Quality Model should exceed the threshold to set the confidence level reaches 90% or more and to fulfil the requirements of mobile application market. Threshold for Quality Product dimension weight is 2% and for Quality in Use dimension is 8% [31]. Here is a table 3.3 weighting characteristics and sub characteristics of Product Quality Dimension in ISO 25010 Quality Model.

Table 3.3: Relative Weight Subcharacteristics of Product Quality Dimension

No	Sub-Characteristics	Quality Characteristics Relative Weight
1.1	Functional completeness	6.18%
1.2	Functional correctness	6.32%
1.3	Functional appropriateness	8.22%
2.1	Time behaviour	3.36%
2.2	Resource Utilization	5.70%
2.3	Capacity	3.51%
3.1	Co-existence	2.60%
3.2	Interoperability	2.52%
4.1	Appropriateness recognizability	7.42%
4.2	Learnability	3.07%
4.3	Operability	4.75%
4.4	User error protection	1.13%
4.5	User interface aesthetics	5.59%
4.6	Accessibility	2.27%
5.1	Maturity	3.33%
5.2	Availability	1.13%
5.3	Fault Tolerance	0.91%
5.4	Recoverability	1.50%
6.1	Confidentiality	4.28%
6.2	Integrity	4.46%
6.3	Non-repudiation	8.00%
6.4	Accountability	6.11%
6.5	Authenticity	3.65%

No	Sub-Characteristics	Quality Characteristics Relative Weight
7.1	Modularity	0.55%
7.2	Reusability	0.55%
7.3	Analyzability	0.55%
7.4	Modifiability	0.55%
7.5	Testability	0.22%
8.1	Adatability	0.55%
8.2	Installability	0.66%
8.3	Replaceability	0.33%

Here is a table 3.4 weighting characteristics and sub characteristics of Quality in Use Dimension in ISO 25010 Quality Model.

Table 3.4: Relative Weight Subcharacteristics of Quality in Use Dimension

No	Sub-Characteristics	Quality Characteristics Relative Weight
1	Effectiveness	9.54%
2	Efficiency	9.54%
3.1	Usefulness	10.15%
3.2	Trust	15.70%
3.3	Pleasure	11.61%
3.4	Comfort	10.06%
4.1	Economic Risk Mitigation	8.60%
4.2	Health and Safety Risk Mitigation	8.04%
4.3	Environmental Risk Mitigation	3.90%
5.1	Context Completeness	11.51%
5.2	Flexibility	1.36%

The result of weighting there are several sub characteristics that are eliminated because its weight is less than the specified threshold value. Sub characteristics in Quality Product that is development-oriented sub characteristics. Those sub characteristics eliminated because have low relevance to the quality of a mobile application. Sub characteristics that development-oriented are user error protection, availability, fault tolerance, recoverability, modularity, reusability, modifiability, testability, adaptability, installablity and replaceability. In Quality in Use characteristics that have a low relevance to the quality of the mobile app is a sub characteristic environmental risk mitigation and flexibility.

The result of weighting above, there are 6 characteristics and 19 sub characteristics in Product Quality dimension and 5 characteristics 9 sub characteristics on Quality in Use dimension.

3.4.2 Research Instruments

The research instrument consists of instruments to test software based on any characteristics of the ISO 25010 Quality Model in Product Quality dimension and Quality in Use dimension. The research instrument designed to measure the quality of transportation service application GO-JEK based on any characteristics with quantitative assessment.

3.4.2.1 Characteristic Functional Suitability Instruments

Characteristics of functional suitability testing used black-box testing method with a test case that contains all the functions that exist in transportation service application GO-JEK. Black box testing (also called functional testing) is testing that ignores the internal mechanism of a system or component and focuses solely on the outputs generated in response to selected inputs and execution conditions [32].

Functional testing should ensure that every function in the transportation service application GO-JEK should run in accordance with properly. A test plan is a document that describes the scope, approach, resources, and all the activity in the test, which identifies test items, the features to be tested, the testing tasks, who will do each task, and any risks requiring replacement plan. An important component of the test plan is the individual test cases [32].

1. Subcharacteristic Functional Completeness

Measurement of sub characteristics functional completeness aims to ensure the GO-JEK application has a complete function that can facilitate the objectives and needs of the user corresponding transportation service application facilities in general. Making the functional completeness sub characteristics instrument designed based on observations that have been conducted by author of the transportation service application similar with GO-JEK that is rated 3.5 scale 4 in GooglePlay and AppStore. These results are used to be points of questions. The results of the observation of these functions can be seen in Table 3.5 below.

Table 3.5: Observation Result of Transportation Service Application

No	Fungsi	GO-JEK	GRAB	UBER	MyBluebird
1	Login with social media	-	X	X	-
2	User registration	X	X	X	X
3	Pick up location based on GPS	X	X	X	X
4	Pick up location by input	X	X	X	X
5	Destination location by input	X	X	X	X
6	Location history/ frequent location	X	X	-	X
7	Determine the path of the journey	-	-	-	X
8	Notes	X	X	X	X
9	Contact driver	X	X	X	X
10	Notification for finding driver	X	X	X	X
11	Driver details information	X	X	X	X
12	Tracking arrival status	X	X	X	X
13	Multiple order	X	-	-	X
14	Share journey	-	X	X	X
15	Cancel booking	X	X	X	X
16	Feedback for rating rider	X	X	X	X
17	Fungsi Wallet/Credit	X	X	X	X
18	Account	X	X	X	X
19	History order	X	X	X	X
20	E-Receipt	-	-	X	X
21	Help menu	X	-	X	-
22	Call Support	X	X	-	-

2. Subcharacteristics Functional Correctness dan Functional Appropriateness

Measurement of sub characteristics functional correctness aims to determine the functions of the GO-JEK application gives correct results. While functional appropriateness ensure the functions of the application GO-JEK gives appropriate results. The test plan is used both sub characteristics, namely Functional Correctness and Functional Appropriateness can be seen in table 3.6 below.

Table 3.6: Test Plan for Subcharacteristic Functional Correctness dan Functional Appropriateness Testing

No	Function	Expected Results
1	Open GO-JEK (Never Sign Up)	Displays sign in and sign up page.
2	Sign In	Displays the main page (home page) which contains all features of the GO-JEK applications.
3	Forget Password	Displays a page for reset password.
3.1	Reset password	Send a password reset link to the email address that has been inputted.
4	Sign up	Displays sign up page.
	Menu in GO-JEK App	
5	History	Displays user history order.
5.1	In progress	Displays user history order is in progress.
5.2	Completed	Displays user history order that has been completed.
6	Help	Displays the help menu for using the features of the application GOJEK.
7	My Account	Displays the account settings menu.
7.1	Profile	Displays user data.
7.2	Change Password	Displays page to change the user password.
7.3	Terms of service	Displays information about the terms and conditions of use GOJEK applications.
7.4	Privacy policy	Displays information GOJEK app's privacy policy.
7.5	Rate the app	Connects to the store to give GOJEK app rating.
7.6	Logout	Get out of main page.
	GO-JEK Services	
8	GO-PAY	Displays information about the credit balance.
8.1	Redeem	Process the voucher code that has been input by the user and the credit balance will be added automatically.
8.2	Top up	Displaying information in various ways to top up the credit balance along the steps.
9	GO-RIDE	Showing page to make a reservation service GO-RIDE.
9.1	Set pickup location	Showing a map the location of a pick up in accordance with the user input.the user input.
9.2	Add note pickup location	Add captions pickup location details.
9.3	Set destination location	Showing a map the location of destination in accordance with what is on the user input.
9.4	Add note destination location	Add captions destination location details.

No	Function	Expected Results
9.5	Order	Continue the process of ordering GO-RIDE services in accordance with the selection method of payment in advance, then display profile GO-RIDE driver who will pick up the user.
10	GO-CAR	Showing page to make a reservation service GO-CAR.
10.1	Set pickup location	Showing a map the location of a pick up in accordance with the user input.the user input.
10.2	Add note pickup location	Add captions pickup location details.
10.3	Set destination location	Showing a map the location of destination in accordance with what is on the user input.
10.4	Add note destination location	Add captions destination location details.
10.5	Order	Continue the process of ordering GO-CAR services in accordance with the selection method of payment in advance, then display profile GO-CAR driver and car details who will pick up the user.
11	GO-FOOD	Showing page to make a reservation service GO-FOOD.
11.1	Search	Displaying search results about the food and restaurant.
11.2	Near Me	Displays a list of nearby restaurants from the user's location when booking.
11.3	Top Picks	Displays a list of the top food picks.
11.4	Recommended Dishes	Displays a list of recommended foods.
11.5	Explore	Displays a list of foods based on the criteria and type.
11.6	Suggest restaurant	Showing page for registered the user fill the restaurant to be a GO-FOOD partner.
11.7	Choosing food at one restaurant	Showing information food, location and hours of operation restaurant, and the menu at the restaurant.
11.7.1	Choosing food menu	Displays a list of foods and the user can charge the amount to be booked.
11.7.2	Order	Continue booking process in accordance with the payment method selection first and then display the driver profile that will deliver customer order.
12	GO-MART	Showing page to make a reservation service GO-MART

No	Function	Expected Results
12.1	Search	Displaying search results about the goods and stores.
12.2	Delivery to	Displays map location for delivery of goods ordered.
12.3	Choose the category of goods	Showing information store where the purchase of goods.
12.3.1	Choose the goods	Showing information of goods and the user can fill the amount to be booked.
12.3.2	Order	Continue booking process in accordance with the payment method selection first and then display the driver profile that will deliver customer order.
13	GO-SEND	Showing page to make a reservation service GO-SEND .
13.1	From Pick location	Showing a map the location of shippers in accordance with what is on the user input.
13.2	Location detail	Add captions from pickup location details.
13.3	Contact person	Add a contact sender.
13.4	To Pick location	Showing a map the location of the consignee in accordance with what is on the user input.
13.5	Location detail	Add captions to pickup location details.
13.6	Contact person	Adding contacts receiver.
13.7	Items to deliver	Add what items will be sent.
13.8	Order	Continue the process of ordering services GO-SEND in accordance with the selection method of payment in advance, then display profile GO-SEND driver who will pick up of goods to the sender's location and deliver it to the receiver.
14	GO-BOX	Showing page to make a reservation service GO-BOX.
14.1	Choosing a car	Displays a list of pickup trucks and box cars.
14.1.1	Origin location	Showing a map the location of the goods to be moved in accordance with the user inputted.
14.1.2	Location detail	Add captions to pickup location details.
14.1.3	Contact person	Adding contacts sender.
14.1.4	Instruction	Add special instructions.
14.1.5	Destination location	Displays the destination location map movement of goods in accordance with the user inputted.
14.1.6	Location detail	Add captions for destination location detail
14.1.7	Contact person	Adding contacts receiver.
14.1.8	Instruction	Add special instructions.
14.1.9	Items to deliver	Adding list of goods to be shipped.

No	Function	Expected Results
14.1.10	Extra features	Add additional shipper.
14.1.11	Insurance	Displays insurance options.
14.1.12	Booking time	Feature a selection the time of booking
14.1.13	Next	Displays the details of the order with the total that will be paid by user, and then continue the booking process services GO-BOX in accordance with the selection method of payment, then display the driver profile GO-BOX.
15	GO-MASSAGE	Showing page to make a reservation service GO-MASSAGE.
15.1	FAQ	Displays information about GO-MASSAGE services.
15.2	Book now	Showing the first step to booking services GO-MASSAGE (filling services detail).
15.2.1	Next 1	Displays the second step to booking services GO-MASSAGE (filling the customer data).
15.2.2	Back	Back to first step.
15.2.3	Next 2	Featuring the third step to booking services GO-MASSAGE (review order).
15.2.4	Validate	Process the voucher code in the input by the user and the total price to be paid in accordance with a nominal cut off voucher.
15.2.5	Back 2	Back to second step.
15.2.6	Order	Continue the process of ordering GO-MASSAGE services in accordance with the selection method of payment in advance, then the customer will receive an email on the profile information masseuse who will process customer orders.
16	GO-CLEAN	Showing page to make a reservation service GO-CLEAN.
16.1	FAQ	Displays information about GO-CLEAN services.
16.2	Book now	Showing the first step to booking services GO-CLEAN (filling services detail).
16.2.1	Next 1	Displays the second step to booking services GO-CLEAN (filling the customer data).
16.2.2	Back 1	Back to first step.
16.2.3	Next 2	Featuring the third step to booking services GO-CLEAN (review order).
16.2.4	Validate	Process the voucher code in the input by the user and the total price to be paid in accordance with a nominal cut off voucher.
16.2.5	Back 2	Back to second step.
16.2.6	Order	Continue the process of ordering GO-CLEAN services in accordance with the selection method of payment in advance, then the customer will receive an email on the profile information cleaner who will process customer orders.

No	Function	Expected Results
17	GO-GLAM	Showing page to make a reservation service GO-GLAM.
17.1	First time user	Display form for filling the user GO-GLAM identity.
17.2	Home	Return to main page GO-GLAM.
17.2.1	Validate	Storing user data GO-GLAM.
17.2.2	See services	Displays information about GO-GLAM services
17.2.3	Book now	Showing page for ordering GO-GLAM.
17.2.4	Choose from our featured talents	Displays a list of the beautician who will be selected by the user.
17.2.5	Order	Continue the process of ordering GO-GLAM services in accordance with the selection of a payment method, then the customer will get an email about the profile information beautician who will process customer orders.
18	GO-TIX	Showing page to make a reservation service GO-TIX.
18.1	Events	Displays a list of events with the time and place of event information.
18.1.1	Search	Showing search results event.
18.1.2	Choosing event	Showing page booking tickets for the event.
18.1.3	Next	Displaying details of the order with the total to be paid by the user.
18.1.4	Purchase	Continue the process of ordering GO-TIX services in accordance with the selection method of payment.
18.2	Movies	Displays a list of movies and a description of the genre.
18.2.1	Search	Showing search results movie.
18.2.2	Choosing movie	Showing locations cinema that showing the movie.
18.2.3	Pick seat	Featuring seating options after selecting movie showtimes.
18.2.4	Review order	Displays details of the order.
18.2.5	Order	Continue the process of ordering GO-TIX services in accordance with the selection method of payment.
19	GO-BUSWAY	Displays the user's location.
19.1	Search	Displays a list of busway shelter.
19.2	Go to this shelter	Displays selected shelter details.
19.3	Request GO-JEK	Displays menu GO-RIDE.

3.4.2.2 Characteristic Performance Efficiency Instruments

Characteristics performance efficiency, there are three sub characteristics, namely, time behavior, resource utilization and capacity.

1. Subcharacteristic Time Behavior

Measurement of sub characteristics time behavior aimed to examine GO-JEK application in processing time and provide a response when the application is used. Measuring the quality of the GO-JEK application on sub characteristics time behavior, was measured by calculating the average response time when an application executes a function. This test was conducted to evaluate the compliance of the system or component with specified performance requirements [32]. A list of functions contained in the test plan tested instrument sub characteristics Functional Correctness and Functional Appropriateness.

2. Subcharacteristic Resource Utilization

Measurement of sub characteristics resource utilization is measured by observing the processing resources when the application is used. The resource is the memory usage when the GO-JEK application is installed and when the GO-JEK application is running. Testing is done by observation of the application when the installation process and when it is executed.

3. Subcharacteristic Capacity

Measurement of sub characteristics capacity aimed to examine the GO-JEK appication in providing maximum limit. Measuring the quality of the GO-JEK application on sub characteristics capacity with observations on the application when processing multiple orders. Test plan to test the capacity subcharacteristics contained in the following table.

Table 3.7: Test Plan for Subcharacteristic Capacity Testing

No	Test Case	Expected Results
1	Booked multiple orders with one of GO-JEK service.	Applications can process all orders well.
2	Booked multiple orders with some of GO-JEK service.	Applications can process all orders well.
3	Add items into the shopping cart as many as 100 items when using the GO-MART.	Applications can add items to the shopping cart more than 100 items.
4	Adding food in a shopping cart of 100 items when using the GO-FOOD.	Applications can add items to the shopping cart more than 100 items.

3.4.2.3 Characteristic Compatibility Instruments

Characteristics compatibility, there are two sub characteristics, namely, co-existence and interoperability.

1. Subcharacteristic Co-Existence

Measurement of sub characteristics co-existence amied to determine the ability of GO-JEK application when running on the device and operating system. Testing is done by install and run applications on different devices and different screen sizes and dimensions of the operating system. Test plan for testing sub characteristics co-existence can be seen on table below.

Table 3.8: Test Plan for Subcharacteristic Co-Existence Testing

No	Test Case	Expected Results
1	GO-JEK application installed on the device for at least Android 4.0 with a screen <6 inch.	GO-JEK application successfully installed.
2	GO-JEK application installed on the device for at least Android 4.0 with a screen >6 inch.	GO-JEK application successfully installed.
3	GO-JEK application installed on the device for at least iOS 7.0 with a screen <6 inch.	GO-JEK application successfully installed.
4	GO-JEK application installed on the device for at least iOS 7.0 with a screen >6 inch.	GO-JEK application successfully installed.
5	Run GO-JEK features on the device at least Android 4.0 with a screen <6 inch.	GO-JEK application runs well.
6	Run GO-JEK features on the device at least Android 4.0 with a screen >6 inch.	GO-JEK application runs well.
7	Run GO-JEK features on the device at least iOS 7.0 with a screen <6 inch.	GO-JEK application runs well.
8	Run GO-JEK features on the device at least iOS 7.0 with a screen >6 inch.	GO-JEK application runs well.

2. Subcharacteristic Interoperability

Measurement of sub characteristics interoperability aims to determine the ability of GO-JEK applications in exchanging information with other systems.

Tests conducted test plan as follows.

Table 3.9: Test Plan for Subcharacteristic Interoperability Testing

No	Test Case	Expected Results
1	Enter your name and phone number from a contact when booking process available in the phone user.	Access contacts and managed to enter the name and phone number on the data from the contact.
2	Call driver	Displays the number of calls to the driver automatically.
3	SMS driver	Displays message menu ready to send a message to the driver.
4	Call Support	Make a call to customer service GO-JEK.
5	Rate this App	Accessing GOJEK in PlayStore or Appstore to rate the app.
6	Forget password	Send reset password to email that written by user.
7	Maps	Displays Google Maps.

3.4.2.4 Characteristic Usability Instruments

Instrument of characteristics usability using a questionnaire that filled out by the respondents. The statement adopted by the USE Questionnaire by Arnold M. Lund (2001) that was adjusted the needs of this research. These statements represent the sub characteristics from the characteristics of each Apropriateness Recognizability, Learnability, Operability, User Error Protection, User Interface Aesthetics and Accessability. Instrument of characteristics usability can be seen in the following table.

Table 3.10: Characteristic Usability Instruments

Subcharacteristics	Variable	Statement	No. Item	Total
4.1 Apropriateness Recognizability	Apr	According to my needs.	1	1
4.2 Learnability	Lrn01	Easy to learn.	2	2
	Lrn02	Learn how to use quickly.	3	
4.3 Operability	Opr01	Easy to use (operated).	4	2
	Opr02	Requires a short step when used.	5	

Subcharacteristics	Variable	Statement	No. Item	Total
4.4 User Error Protection	UEr01	Providing prevention against the mistake I did.	6	2
	UEr02	Provide reparation to the mistake I did.	7	
4.5 User Interface Aesthetics	UIA01	Having display user friendly.	8	2
	UIA02	Have a consistent display.	9	
4.6 Accessability	Acs01	Can be used in certain conditions.	10	2
	Acs02	Can be used by users with a broad range.	11	
Total of Statement			11	

3.4.2.5 Characteristic Reliability Instruments

Instrument sub characteristic reliability is based on observations of the functions that related to the application reliability when used in certain conditions. In testing the characteristics of reliability, there is one sub characteristic that is sub characteristic maturity with further explanation as follows.

1. Subcharacteristic Maturity

Measurement sub charactheristic maturity aims to ensure the application GO-JEK can survive from the failure or software error. Making instrument sub charactheristic maturity designed based on observations conducted by the author of the GO-JEK application by observing the functions associated with the reliability of the application. In a booklet written by Duy Huynh [16] maturity testing is done by; (1)The objective of testing is to show that the system and software work, (2) The objective of testing is based on system requirements.

The results of further observations used to create test cases and test plan are outlined in the following table.

Table 3.11: Test Plan for Subcharacteristic Maturity Testing

No	Test Case	Expected Results
1	Turning off the the Internet connection with disable data packet or wifi when ordering process GO-JEK service.	The booking process was not continued and application GO-JEK provide notification there is no internet access.

No	Test Case	Expected Results
2	Turning on airplane mode when you're ordering process GO-JEK service.	The booking process was not continued and application GO-JEK provide notification that airplane mode is on, turn off to continue the booking process.
3	Running multiple applications to use a lot of RAM usage, and then run the GO-JEK application.	GO-JEK application continues to run and can be used with the processing time of less than 12 seconds.
4	Giving too many instructions such as requesting many functions almost simultaneously.	GO-JEK applications can continue to run even if the processing wait time longer than normal.

3.4.2.6 Characteristic Security Instruments

Instrument characteristic security using Goal-Question-Metrics (GQM) to define software security measures developed by Shareeful Islam and Paolo Falcarin[18]. The instrument used in this research were adopted from GQM form of test plan for each characteristic in GO-JEK application testing.

1. Subcharacteristic Confidentiality

Testing sub characteristics confidentiality aims to ensure the capability of GO-JEK application of providing protection permissions on each user. Making instrument the sub characteristics confidentiality is designed based on the adoption of the GQM [18] about the protection of access and observation that have been made by author to observe the functions of the GO-JEK application that related to security permissions. Testplane sub characteristic confidentialy can be seen in the following table.

Table 3.12: Test Plan for Subcharacteristic Confidentiality Testing

No	Test Case	Expected Results
1	Filling the registration data by clearing the data one field.	Field displays an error message to fill empty attribute.
2	Filling the registration data with a password that is short or less than 5 characters.	Field displays the error message data is password is too short.
3	Filling the registration data with the name field of one character.	Display an error message that field name is too short.
4	Filling the registration data with passwords containing only character.	Display an error message data is password must contain at least 1 number.

No	Test Case	Expected Results
5	Fill data to confirm the password field is different from the password data to be used.	Display an error message password does not match the password confirmation field.
6	Filling the registration data with email address is incomplete.	Displays an error message email address is incomplete.
7	Filling the registration data by using an email address that has been used.	Displays an error message email data has been used.

2. Subcharacteristic Integrity

Testing sub characteristics integrity aims to ensure the capability of GO-JEK application preventing permission that not allowed to enter the system. Making instrument the sub characteristics integrity is designed based on the adoption of the GQM [18] about the integrity of access and observation that have been made by author to observe the functions of the GO-JEK application that related to prevention on user access. Testplane sub characteristic integrity can be seen in the following table.

Table 3.13: Test Plan for Subcharacteristic Integrity Testing

No	Test Case	Expected Results
1	Login: a. Username filled with incorrect data. b. Password is filled with the correct data.	Display an error message to check the username and password.
2	Login: a. Username filled with correct data. b. Password is filled with the incorrect data.	Display an error message to check the username and password.
3	Request for reset password.	Send a password reset message to the email that has been inputted by the user.
4	Login with incorrect data more than three times.	The system will block the account for a certain time so that the user can not login.
5	Do not open the application more than one week.	The system will be to logout and displays login page.

3. Subcharacteristic Non-repudiation

Testing sub characteristics non-repudiation aims to ensure the capability of GO-JEK application provide evidence of acts or transactions performed

by the user. Making instrument the sub characteristics non-repudiation is designed based on the adoption of the GQM [18] and observation that have been made by author to observe the functions of the GO-JEK application that related with transactions. Testplane sub characteristic non-repudiation can be seen in the following table.

Table 3.14: Test Plan for Subcharacteristic Non-repudiation Testing

No	Test Case	Expected Results
1	User registration via the GO-JEK application.	The system provides evidence of registration via email.
2	Reservations service GO-JEK through the application.	Booking list can be seen in the menu complete order history.
3	Cancellation order service GOJEK through the application.	Booking list can be seen in the history menu cancel the order.
4	The booking process has been completed.	The system provides evidence booking transactions and payment or billing via email.

4. Subcharacteristic Accountability

Testing sub characteristics accountability aims to ensure the capability of GO-JEK application tracking all activities performed by the user. Making instrument the sub characteristics accountability is designed based on the adoption of the GQM [18] and observation that have been made by author to observe the functions of the GO-JEK application that related with user activities. Testplane sub characteristic accountability can be seen in the following table.

Table 3.15: Test Plan for Subcharacteristic Accountability Testing

No	Test Case	Expected Results
1	Open the history order menu.	The system provides information reservation made by the user, such as time and date and details of service booked or canceled by the user.
2	Search	The system provides information search results that have been done by the user.

No	Test Case	Expected Results
3	Leave a comment or rating for service driver, beautician, cleaner or masseur.	The rating system provides a list of information or comment that has been given by the user.
4	Top up	The system provides information of charging and discharging a list of credit balances.

5. Subcharacteristic Authenticity

Testing sub characteristics authenticityaims to ensure the capability of GO-JEK application providing confirmation of the authenticity of the user data. Making instrument the sub characteristics authenticityis designed based on the adoption of the GQM [18] and observation that have been made by author to observe the functions of the GO-JEK application that related the authenticity of the user data. Testplane sub characteristic authenticity can be seen in the following table.

Table 3.16: Test Plan for Subcharacteristic Authenticity Testing

No	Test Case	Expected Results
1	Register user data	The system sends a verification code via email or SMS
2	Login on multiple devices without logout first.	Showing information that account logged in on other devices
3	Changing the password by filling the field for the old password, the new password, confirm the new password.	Password changes successfully.
4	Replace the data in the account.	Update data successfully performed and account data successfully replaced.

3.4.2.7 Quality in Use Dimension Instruments

Instruments Quality in Use dimension using a questionnaire to be filled out by the respondent. The statement adopted by the USE Questionnaire by Arnold M. Lund (2001) adapted to the needs of research. These statements represent each sub characteristics of the characteristics of effectiveness, efficiency, satisfaction, freedom from risk, and context coverage. Instruments

Quality in Use dimension can be seen in the following table.

Table 3.17: Quality in Use Dimension Instruments

Subcharacteristics	Variable	Statement	No. Item	Total
1. Effectiveness	Eftv01	Help to become more effective.	1	2
	Eftv02	Achieve goals more easily.	2	
2. Efficiency	Efcn01	Save time when used.	3	2
	Efcn02	Help to become more productive.	4	
3.1 Usefulness	Usef01	Give a positive impact.	5	2
	Usef02	Give benefits.	6	
3.2 Trust	Trs01	Giving a trust to be used according to the needs as its function.	7	2
	Trs02	Fulfill according to desire.	8	
3.3 Pleasure	Pls01	Pleasure to use.	9	2
	Pls02	Provide satisfaction.	10	
3.4 Comfort	Cmf01	Comfortable to use.	11	2
	Cmf02	Is a must have application.	12	
4.1 Economic Risk Mitigation	EcoRM	Creating a user becomes more economical.	13	1
4.2 Health and Safety Risk Mitigation	HSRM	Reduce the risk of crime in the user themselves.	14	1
5. 1 Context Completeness	CCmp	Providing complete component functions, features or context.	15	1
Total of Statement			15	

3.4.3 Determination of Data Analysis Techniques

Data Analysis Techniques aimed to analyze the test data based research instruments. Further explanation below.

3.4.3.1 Analysis Characteristic Functional Suitability

Analysis of the entire sub characteristics on the characteristics functional suitability using a test case with Guttman scale. Guttman scale is a scale developed by Louis Guttman where each answer item must be firm and consistent such as "Yes" or "No" [13].

After testing all the answers "yes" calculated the percentage of feasibility. The formula is as follows feasibility percentage.

$$FeasibilityPercentage\,(\%) = \frac{ObservedScore}{MaximumScore} \tag{3.4.1}$$

Then each result is compared with the assessment table as follows.

1. Indicator of Subcharacteristic Functional Completeness

Assessment indicators for sub characteristics functional completeness obtained from the observation of some transportation service application which is then arranged by the author. Indicators sub characteristics functional completeness are as follows.

Table 3.18: Indicator of Subcharacteristic Functional Completeness

Level	Indicator	Description
1	0% - 20% Functional Completeness	Very Bad
2	21% - 40% Functional Completeness	Bad
3	41% - 60% Functional Completeness	Moderate
4	61% - 80% Functional Completeness	Good
5	81% - 100% Functional Completeness	Very Good

2. Indicator of Subcharacteristic Functional Correctness dan Functional Appropriateness

Assessment indicators for the sub characteristics functional correctness and functional appropriateness adopted from the research by Rodriguez, M. & Piattini, M. entitled “Evaluation of Software Product Functional Suitability: A Case Study”. Mobile application that has a good quality if it is at level 4 and 5. Level 4 and 5 fulfil the characteristic functional suitability of the third sub characteristic namely functional completeness, functional correctness and functional appropriateness [25]. Here is a table indicators for the sub characteristics functional correctness and functional appropriateness.

Table 3.19: Indicator of Subcharacteristic Functional Correctness dan Functional Appropriateness [25]

Level	Indicator	Description
1	0% - 20%	There cannot be sub characteristics. It means very bad quality.
2	21% - 40%	The maximum number of sub characteristics is one. It means bad quality.
3	41% - 60%	The maximum number of sub characteristics is two. It means good enough quality.

Level	Indicator	Description
4	61% - 80%	There are all of sub characteristics. It means good quality.
5	81% - 100%	There are all of sub characteristics. It means very good quality.

3.4.3.2 Analysis Characteristic Performance Efficiency

On the characteristic performance efficiency, the analysis is conducted for each sub characteristics. Sub characteristics are time behavior, resource utilization and capacity. Explanation technique analaisis each sub characteristics are as follows.

1. Indicator of Subcharacteristic Time Behavior

Quality analysis of the sub characteristic performance efficiency time behavior is done by calculating the average response time of the application to retrieve data from the server and display it. The results compared with table user satisfaction by Hoxmeier and DiCesare [14]. Users get the highest satisfaction when the response time in a state of delay of 0 seconds while satisfaction remained in the range of 3 to 9 seconds and decreased if more than 12 seconds [14]. The following is a standard measurement of user satisfaction contained in the following table.

Table 3.20: User Satisfaction Measurement[14]

Level	Response time (seconds)	Predicate
1	>15	Extremely dissatisfied
2	12-15	Not satisfied
3	9-12	Quite satisfied
4	3-9	Satisfied
5	< 3	Very satisfied

2. Indicator of Subcharacteristic Resource Utilization

Analysis of sub characteristic resource utilization was observed on memory usage when an application installs and when the application runs. Then, the results compared with table resource utilization usage. Table resource utilization usage obtained from the observation of the author of some transportation service application that is similar to GO-JEK and had a rating above 3.5 scale 5 such as GRAB, UBER and My Bluebird. Here is a table of memory usage in the transportation service applications.

Table 3.21: Memory Usage on Transportation Service Applications

Transportation Service Apps	iOS		Android	
	Instalation	Running	Instalation	Running
GO-JEK	83.6 MB	86.7 MB	23.92 MB	40.80 MB
GRAB	49.4 MB	44.9 MB	10.43 MB	22.25 MB
UBER	84.0 MB	76.9 MB	19.94 MB	35.91 MB
My Bluebird	62.6 MB	55.0 MB	14.51 MB	24.76 MB
Average Memory Usage	68.65 MB	65.87 MB	17.20 MB	30.93 MB

On average such a reference to be an indicator of the use of resource utilization that will be very good predicate and multiples of two of the average would be a very bad predicate. Here is a table of resource utilization indicator usage.

Table 3.22: Indicator of Subcharacteristic Resource Utilization

Level	Resource Utilization Usage				Predicate
	iOS Instalation (MB)	iOS Running (MB)	Android Instalation (MB)	Android Run-ning(MB)	
1	120-137	118-131	33-35	56-61	Very Bad
2	108-120	105-117	29-32	50-55	Bad
3	95-107	92-104	25-28	43-49	Moderate
4	82-94	78-91	21-24	36-42	Good
5	68-81	65-78	17-20	30-35	Very Good

3. Indicator of Subcharacteristic Capacity

Analysis sub characteristic capacity using test cases Guttman scale [13]. . Then, the number of "Yes" is calculated and matched with indicators subkarakteristik capacity to be able to know the quality of the aspects of the application capacity. The indicators contained in the following table.

Table 3.23: Indicator of Subcharacteristic Capacity

Level	Indicator	Description
1	No testcase in accordance with expectation result.	Capacity is very low.
2	There are 1 testcase in accordance with expectation result.	Capacity is low.
3	There are 2 testcase in accordance with expectation result.	Capacity is enough.
4	There are 3 testcase in accordance with expectation result.	Capacity is high.
5	All testcase in accordance with the expectation result.	Capacity is very high.

3.4.3.3 Analysis Characteristic Compatibility

On the characteristics compatibility, analysis were conducted for each sub characteristics. Sub characteristics are co-existence and interoperability. Explanation technique analaisis each sub characteristics are as follows.

1. Indicator of Subcharacteristic Co-existence

Analysis of sub characteristic co-existence using a test case with Guttman scale [13]. Then, the number of "Yes" is calculated and compared to the indicator of sub characteristic co-existence for ensuring the quality of the application when it run with devices and different operating systems. The indicators contained in the following table.

Table 3.24: Indicator of Subcharacteristic Co-existence

Level	Indicator	Description
1	All the test results are not in accordance with the expectation result.	Very Bad
2	There were 5-7 the test results are not in accordance with the expectation result.	Bad
3	There were 3-4 the test results are not in accordance with the expectation result.	Moderate

Level	Indicator	Description
4	There were 1-2 the test results are not in accordance with the expectation result.	Good
5	All the test results in accordance with the expectation result.	Very Good

2. Indicator of Subcharacteristic Interoperability

Analysis of sub characteristic interoperability using a test case with Guttman scale [13]. Then, the number of "Yes" is calculated and compared to the indicator of sub characteristic interoperability for ensuring the quality of the application to exchange information with the system or other applications. The indicators contained in the following table.

Table 3.25: Indicator of Subcharacteristic Interoperability

Level	Indicator	Description
1	All the test results are not in accordance with the expectation result.	Very Bad
2	There were 5-6 the test results are not in accordance with the expectation result.	Bad
3	There were 3-4 the test results are not in accordance with the expectation result.	Moderate
4	There were 1-2 the test results are not in accordance with the expectation result.	Good
5	All the test results in accordance with the expectation result.	Very Good

3.4.3.4 Analysis Characteristic Usability

Before the questionnaires distributed, tested the validity and reliability of the 30 respondents. Validity indicates the degree of determination of the data actually happened on the object with the data that can be collected by researchers [27]. The results of the research valid if there is a similarity between the data collected by the data that is actually happening on the object under research. The instruments are valid means of measuring instruments used to obtain data (measure) were valid. Valid means the instrument can be used to measure what should be measured [27]. According Masrum, in

Sugiyono 2008 [27], states that the item has a positive correlation with the criterion (total score) as well as a high correlation also indicates that the item has a higher validity.

The validity result can be seen by using the Pearson Correlation value between each variable item with the variable it self. The minimum number of Pearson correlation value to be valid for the research is 0,3610[27]. It refers to Table R by using the value of signicance level at 5% with 30 number of sample [27].

Reliability is related to the degree of consistency or constancy of data in a certain time interval [27]. The instrument has a reliability can be used to measure many times that produce the same data (consistent). According Sugiyono in 2008 [27], that reliability is the extent to which the results of measurements using the same object, will generate the same data.

Cronbach alpha values of reliability compared with the value of consistency contained in the following table consistency Cronbach alpha.

Table 3.26: Reliability Index Criteria [27]

Level	Interval	Criteria
1	< 0.200	Very low.
2	0.200 - 0.399	Low.
3	0.400 - 0.599	Moderate.
4	0.600 - 0.799	High.
5	0.800 - 1.000	Very high.

Testing usability characteristics using a Likert scale as the scale of measurement in testing instrument where each answer item usability instrument has a gradation from very positive to very negative[28]. In this study the scale used is a 5-point Likert scale as described above on the data collection method.

Scale calculation results are then calculated by the following formula.

$$Q = \frac{\sum IxS}{MaxU} x100\% \tag{3.4.2}$$

$$\sum IxS = (IxS)_1 + (IxS)_2 + ... + (IxS)_n$$

Where:

Q = Questionnaire value

I = Interpretation that was answered by the user (STS, TS, N, S, SS)

S= Likert Scale

MaxU = Maximum value (Total of statement xThe highest likert scale)

The results of these calculations compared with the table that adopted criteria of interpretation of scores of research Guritno, Sudaryono and Raharja [12] as follows.

Table 3.27: Score Interpretation

Level	Percentage of Achievement	Interpretation
1	0% - 20%	Feasibility is Very Bad
2	21% - 40%	Feasibility is Bad
3	41% - 60%	Feasibility is Moderate
4	61% - 80%	Feasibility is Good
5	81% - 100%	Feasibility is Very Good

3.4.3.5 Analysis Characteristic Reliability

On the characteristics reliability, analysis was conducted for one sub characteristic. Sub characteristic is maturity. Explanation technique analaisis each sub characteristics are as follows.

Analysis of sub characteristic maturity using a test case with Guttman scale [13]. Then, the number of "Yes" is calculated and compared to the indicator of sub characteristic maturity for ensuring the quality of the application when it survive the failure or software error. The indicators contained in the following table.

Table 3.28: Indicator of Subcharacteristic Maturity

Level	Indicator	Description
1	No testcase in accordance with expectation result.	Defense applications of failures or errors is very low.
2	There are 1 testcase in accordance with expectation result.	Defense applications of failures or errors is low.
3	There are 2 testcase in accordance with expectation result.	Defense applications of failures or errors is enough.
4	There are 3 testcase in accordance with expectation result.	Defense applications of failures or errors is high.
5	All testcase in accordance with the expectation result.	Defense applications of failures or errors is very high.

3.4.3.6 Analysis Characteristic Security

Analysis of the characteristics security from the calculation of the Goal-Question-Metrics (GQM) to define software security measures developed by Shareeful Islam and Paolo Falcarin [18]. Measuring the quality of security characteristics GQM is to give a score to each statement contained in the instrument sub characteristics. Scores from metrics for every question are [18]:

1 = Full Compliance

0.5 = Average Compliance

1 = Weak Compliance

After all statements in the test plan for each sub characteristics is given a score, the total score of each characteristic is calculated by the following formula.

$$SS = \frac{\sum scoreQ_n}{TotQ_n} x100\% \tag{3.4.3}$$

$$\sum scoreQ_n = scoreQ_1 + scoreQ_2 + ... + scoreQ_n$$

Where:

SS = Score each sub characteristic on characteristic security

$scoreQ_n$= Scores are given every statement in the test plan

$TotQ_n$= Total of Question in testplan

After calculating the score of each sub characteristik, these results compared with the indicator tables. Here is a table of indicators to sub characteristic confidentiality.

Table 3.29: Indicator of Subcharacteristic Confidentially

Level	Indicator	Description
1	0% - 20%	The ability of applications to protect access privileges to users is very low.
2	21% - 40%	The ability of applications to protect access privileges to users is low.
3	41% - 60%	The ability of applications to protect access privileges to users is moderate.
4	61% - 80%	The ability of applications to protect access privileges to users is high.
5	81% - 100%	The ability of applications to protect access privileges to users is very high.

Here is a table of indicators to sub characteristic Integrity

Table 3.30: Indicator of Subcharacteristic Integrity

Level	Indicator	Description
1	0% - 20%	The ability to prevent permissions that are not allowed is very low.
2	21% - 40%	The ability to prevent permissions that are not allowed is low.
3	41% - 60%	The ability to prevent permissions that are not allowed is moderate.
4	61% - 80%	The ability to prevent permissions that are not allowed is high.
5	81% - 100%	The ability to prevent permissions that are not allowed is very high.

Here is a table of indicators to sub characteristic Non-repudation

Table 3.31: Indicator of Subcharacteristic Non-repudation

Level	Indicator	Description
1	0% - 20%	The ability of application provides evidence for the actions / transactions performed by users is very low.
2	21% - 40%	The ability of application provides evidence for the actions / transactions performed by users is low.
3	41% - 60%	The ability of application provides evidence for the actions / transactions performed by users is moderate.
4	61% - 80%	The ability of application provides evidence for the actions / transactions performed by users is high.
5	81% - 100%	The ability of application provides evidence for the actions / transactions performed by users is very high.

Here is a table of indicators to sub characteristic Accountability

Table 3.32: Indicator of Subcharacteristic Accountability

Level	Indicator	Description
1	0% - 20%	The ability of tracking application activities performed by the user is very low.
2	21% - 40%	The ability of tracking application activities performed by the user is low.
3	41% - 60%	The ability of tracking application activities performed by the user is moderate.
4	61% - 80%	The ability of tracking application activities performed by the user is high.
5	81% - 100%	The ability of tracking application activities performed by the user is very high.

Here is a table of indicators to sub characteristic Authenticity

Table 3.33: Indicator of Subcharacteristic Authenticity

Level	Indicator	Description
1	0% - 20%	The ability of the application to confirm the authenticity of the user data is very low.
2	21% - 40%	The ability of the application to confirm the authenticity of the user data is low.
3	41% - 60%	The ability of the application to confirm the authenticity of the user data is moderate.
4	61% - 80%	The ability of the application to confirm the authenticity of the user data is high.
5	81% - 100%	The ability of the application to confirm the authenticity of the user data is very high.

3.4.3.7 Analysis Quality in Use Dimension

Steps conducted to analyze the quality of the Quality in Use dimensions is the same as characteristic usability analysis. First to test the validity and reliability of questions on the questionnaire that was distributed to 30 respon-

dents, then analyze the answers and compared with interpretation criteria score table as on the analysis of the characteristic usability.

3.5 Calculation of Quality Value

The calculation of the quality value of transportation service application GO-JEK done by calculate score of each characteristic ISO 25010 Quality Model, the characteristic value obtained from the calculation of the total score sub characteristic. Calculation of the total each sub characteristic as described in the previous section. After that value sub characteristic by observation or questionnaire results shown by the level of the indicator, the level value calculated by weighting sub characteristic to see the calculation result is equal or lower to than the relative weight. Sub characteristic value is obtained from the following equation.

$$valueSC_n = W_n x \frac{L_n}{maxL} \tag{3.5.1}$$

Where:

$valueSC_n$= Value of Sub characteristic to-n

W_n = The Relative Weight of Sub characteristic to-n

L_n = Level from observation or questionnaire result of Sub characteristic to-n

$maxL$ = The Highest level each Sub characteristic indicator ($maxL = 5$)

Then, The value of each sub characteristics were summed to obtain the ISO 25010 characteristic value both on Product Quality or Quality in Use dimensions. The calculation of each characteristic is obtained from the following equation.

$$valueC_n = \sum valueSC_n \tag{3.5.2}$$

$$\sum valueSC_n = valueSC_1 + valueSC_2 + ... + valueSC_n$$

Where:

$valueC_n$= Characteristic value to-n

After the value of each characteristic is obtained, then the overall total of all the characteristics calculated by the following equation.

$$TvalueC = \sum valueC_n \tag{3.5.3}$$

$$\sum TvalueC = valueC_1 + valueC_2 + ... + valueC_n$$

Where:

$TvalueC_n$= Total characteristic value

The total value of these characteristics into quantitative values the quality of transportation service application GO-JEK.

Chapter 4

RESULTS AND DISCUSSION

Testing transport service application GO-JEK performed by several methods previously described. Results and discussion from these tests will be used to measure the quality of applications GO-JEK based on the characteristics of ISO 25010 is as follows.

4.1 Relative Weight Characteristics and Subcharacteristics

As described previously, this research uses the 6 characteristics and 19 sub characteristics of the Product Quality dimension and 5 characteristics and 9 sub characteristics on Quality in Use dimension. The weighting of each sub characteristic determined from the adoption of research Luis Ricardo Corral [31] entitled “Software Assurance Model for Mobile Application”.

4.1.1 Relative Weight Characteristics and Subcharacteristics of Product Quality Dimension

The characteristics and sub characteristics most dominant on Product Quality dimension can be seen from its relative weight. The following table lists the relative weight of sub characteristics on product quality dimension with subtotals relative weight characteristics.

Table 4.1: Relative Weight Characteristics and Subcharacteristics of Product Quality Dimension.

No	Characteristics	Subcharacteristics	Relative Weight	
1	Functional Suitability	1.1 Functional completeness	6.18%	20.72%
		1.2 Functional correctness	6.32%	
		1.3 Functional appropriateness	8.22%	
2		2.1 Time behaviour	3.36%	12.57%
		2.2 Resource Utilization	5.70%	
		2.3 Capacity	3.51%	
3		3.1 Co-existence	2.60%	5.12%
		3.2 Interoperability	2.52%	
4		4.1 Appropriateness recognizability	7.42%	23.10%
		4.2 Learnability	3.07%	
		4.3 Operability	4.75%	
		4.5 User interface aesthetics	5.59%	
		4.6 Accessibility	2.27%	
5		5.1 Maturity	3.33%	3.33%
6		6.1 Confidentiality	4.28%	26.53%
		6.2 Integrity	4.46%	
		6.3 Non-repudiation	8.00%	
		6.4 Accountability	6.14%	
		6.5 Authenticity	3.65%	
Sum of Total Weights (Confidence)			91.37%	

Weighting characteristics obtained from the total weight of each sub characteristics. Characteristics of security into the most important characteristics for a quality mobile applications. Here is a graph of weighting characteristics on dimensions of quality product composed of the highest relative weight can be seen in figure 4.1 below.

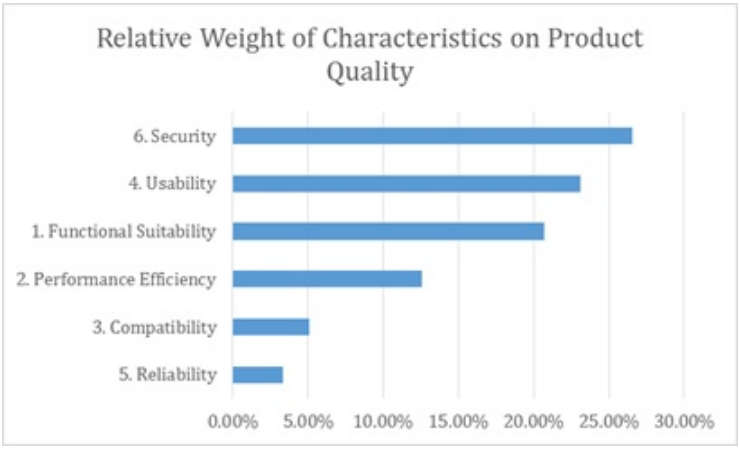


Figure 4.1: Relative Weight Characteristics of Product Quality Dimension

SSub characteristics on Product Quality dimension is very important to the quality of a mobile application is sub characteristic Functional appropriateness. Here is a chart compiled sub characteristics weighting of the highest relative weight on the Product Quality dimension can be seen in Figure 4.2 below.

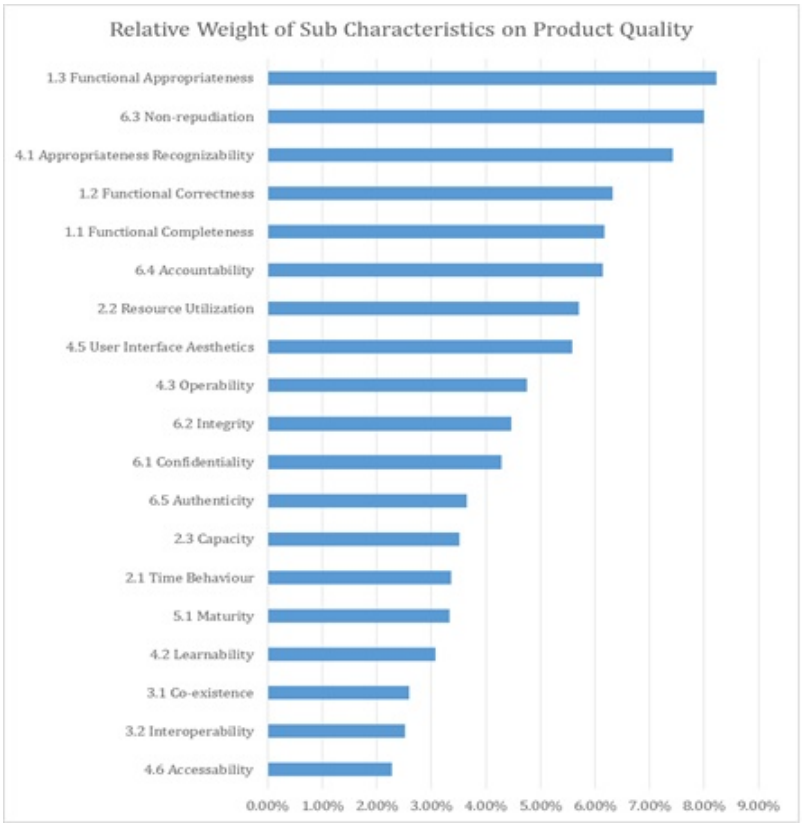


Figure 4.2: Relative Weight Subcharacteristics of Product Quality Dimension

4.1.2 Relative Weight Characteristics and Subcharacteristics of Quality in Use Dimension

The characteristics and sub characteristics most dominant on the Quality in Use dimension can be seen from its relative weight. Here is a table Relative weight characteristics and sub characteristics of Quality in Use dimension as follows.

Table 4.2: Relative Weight Characteristics and Subcharacteristics of Quality in Use Dimension.

No	Characteristics	Subcharacteristics	Relative Weight	
1	Effectiveness		9.54%	9.54%
2	Efficiency		9.54%	9.54%
3	Satisfaction	3.1 Usefulness	10.15%	47.52%
		3.2 Trust	15.70%	
		3.3 Pleasure	11.61%	
		3.4 Comfort	10.06%	
4	Freedom from risk	4.1 Economic risk mitigation	8.60%	16.64%
		4.2 Health and safety risk mitigation	8.04%	
5	Context coverage	5.1 Context completeness	11.51%	11.51%
Sum of Total Weights (Confidence)			94.75%	

Weighting characteristics obtained from the total weight of each sub characteristics. Characteristics satisfaction becomes the most important for a quality mobile applications. Here is a graph of weighting characteristics on Quality in Use dimesion were constructed from the highest relative weight can be seen in Figure 4.3

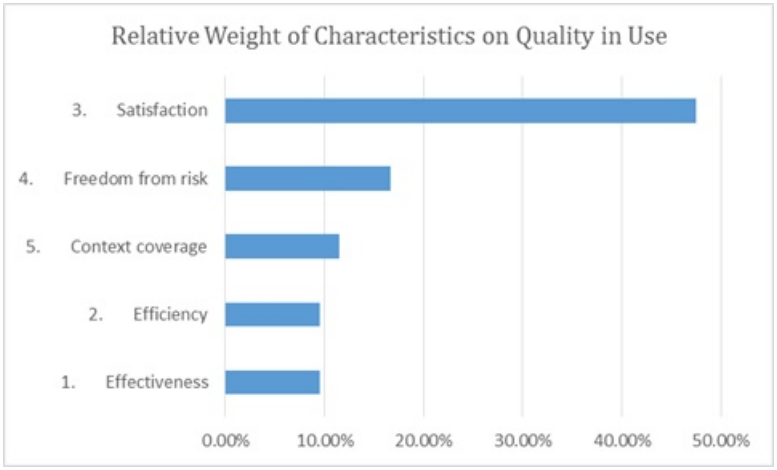


Figure 4.3: Relative Weight Characteristics of Quality In Use Dimension

Sub characteristics on Quality in Use dimension is very important to the quality of a mobile application is sub characteristics of trust. Here is a chart compiled subkarakteristik weighting of the highest relative weight on the dimensions of Quality in Use can be seen in Figure 4.4

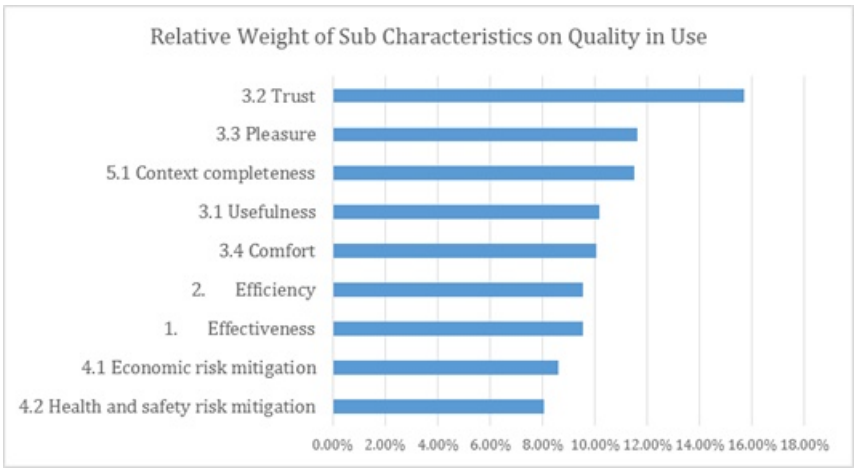


Figure 4.4: Relative Weight Subcharacteristics of Quality in Use Dimension

4.1.3 Priority Ranking

In Table 4.3 and 4.4 each characteristics given a ranking from highest to lowest weight. The ranking aims to see the order sub characteristics that most affect the quality of a mobile application. The following table ranking priority to Product Quality dimension.

Table 4.3: Priority Ranking Subcharacteristics of Relative Weight Product Quality Dimension

No	Subcharacteristics	Relative Weight	Ranking
1.3	Functional appropriateness	8.22%	1
6.3	Non-repudiation	8.00%	2
4.1	Appropriateness recognizability	7.42%	3
1.2	Functional Correctness	6.32%	4
1.1	Functional Completeness	6.18%	5
6.4	Accountability	6.11%	6
2.2	Resource Utilization	5.70%	7
4.5	User InterfaceAesthetics	5.59%	8
4.3	Operability	4.75%	9
6.2	Integrity	4.46%	10
6.1	Confidentially	4.28%	11
6.5	Authenticity	3.65%	12
2.3	Capacity	3.51%	13
2.1	Time Behaviour	3.36%	14
5.1	Maturity	3.33%	15
4.2	Learnability	3.07%	16
3.1	Co-existence	2.60%	17
3.2	Interoperability	2.52%	18
4.6	Accessibility	2.27%	19

The following table priority ranking for Quality in Use dimension.

Table 4.4: Priority Ranking Subcharacteristics of Relative Weight Quality in Use Dimension

No	Subcharacteristics	Relative Weight	Ranking
3.2	Trust	15.70%	1
3.3	Pleasure	11.61%	2
5.1	Context Completeness	11.51%	3
3.1	Usefulness	10.15%	4
3.4	Comfort	10.06%	5
2	Efficiency	9.54%	6
1	Effectiveness	9.54%	7
4.1	Economic Risk Mitigation	8.60%	8
4.2	Health and Safety Risk Mitigation	8.04%	9

4.2 Respondent Characteristics

Based on the results of questionnaires, the respondent data obtained by 100 respondents in accordance with the sample size calculation formula

slovin and standard error of 0.1 or 10%. Respondents are users of the application GO-JEK and have information technology educational background. Respondents data obtained in this research questionnaire form the characteristics of respondents. Respondents characteristics in this research include aspect of gender, age, current residence (domicile), and profession. The following table shows the percentage of respondents overall characteristics.

Table 4.5: Respondent Characteristics

Respondent Characteristics		Frequency	Percentage
Gender	Male	54	54%
	Female	46	46%
	Total	100	100%
Age	< 20	5	5%
	20 - 24	85	85%
	25 - 29	9	9%
	> 30	1	1%
	Total	100	100%
Profession	IT Staff	23	23%
	IT Support	13	13%
	Developer	13	13%
	Lecturer IT	3	3%
	College Student Majoring IT	28	28%
	Fresh Graduate Majoring IT	20	20%
	Total	100	100%
Domicile	South Jakarta	17	17%
	East Jakarta	12	12%
	Central Jakarta	8	8%
	West Jakarta	2	2%
	North Jakarta	1	1%
	Depok	35	35%
	Tangerang	9	9%
	Bekasi	16	16%
	Total	100	100%
Start Using	2013	1	1%
	2014	5	5%
	2015	63	63%
	2016	31	31%

According to Table 4.5 the number of male respondents is 54% and the number of female respondents is 46%. It can show the user the application GO-JEK not only dominated by women or men. The average age of respondents, most is in the range 20-24 years with a percentage of 85%, followed by the age of 26-29 years. This shows the GO-JEK used to assist mobility in

a highly productive age. The job mostly are students majoring in IT with a percentage of 28%. Domicile which has the largest number of respondents is domicile in Depok with a percentage of 35%. Beside that, Users start using GO-JEK application average since 2015.

4.3 Product Quality Measurement of Transportation Service Application GO-JEK on Android Device

Transportation service application GO-JEK tested every characteristic to obtain quantitative quality value. Here are the results of testing GO-JEK with a mobile device type Sony Experia SP operating system Android.

4.3.1 Characteristic Functional Suitability Testing

In accordance with the research instrument and data analysis techniques described in the previous chapter, the characteristics of functional suitability, there are 3 sub-characteristics which has two sub test plan, to test the sub characteristics functional completeness and test plan to test sub characteristics functional correctness and functional appropriateness.

1. Subcharacteristics Functional Completeness

The following table are the test results for sub characteristic functional completeness.

Table 4.6: Test results for Sub characteristics Functional Completeness on Android Device

No	Fungtion	Actual Result
1	Login with social media	NO
2	User registration	YES
3	Pick up location based on GPS	YES
4	Pick up location by input	YES
5	Destination location by input	YES

No	Fungtion	Actual Result
6	Location history/ frequent location	YES
7	Determine the path of the journey	NO
8	Notes	YES
9	Contact driver	YES
10	Notification for finding driver	YES
11	Driver details information	YES
12	Tracking arrival status	YES
13	Multiple order	YES
14	Share journey	NO
15	Cancel booking	YES
16	Feedback for rating rider	YES
17	Fungsi Wallet/Credit	YES
18	Account	YES
19	History order	YES
20	E-Receipt	NO
21	Help menu	YES
22	Call Support	YES

Based on the results of testing sub characteristic functional completeness on Android devices in the table above, the percentage of sub characteristic functional completeness could be identified as the total number of completeness functions are 22:

$$Yes = \frac{18}{22} x 100\% = 81.81\%$$

$$No = \frac{4}{22} x 100\% = 18.19\%$$

From the calculations above sub characteristic functional completeness, results are compared with the table 3.18 indicator of functional completeness. The results were 81.81%, ie at the level 5 with a range of 81% - 100%. This indicates that the application GO-JEK has a very good quality of the functional completeness.

2. Subcharacteristics Functional Correctness dan Functional Appropriateness

The following table are the test results for sub characteristic functional correctness and functional appropriateness. Answer "YES" if the actual result in accordance with expectations, and answer "NO" if the actual result is not in accordance with expectations.

Table 4.7: Testing Result of Subcharacteristic Functional Correctness and Functional Appropriateness on Android Device

No	Function	Actual Result	
		1.2 FCrct	1.3 FAppr
1	Open GO-JEK (Never Sign Up)	NO	NO
2	Sign In	YES	YES
3	Forget Password	YES	YES
3.1	Reset password	YES	YES
4	Sign up	YES	YES
Menu in GO-JEK App			
5	History	YES	YES
5.1	In progress	YES	YES
5.2	Completed	YES	YES
6	Help	YES	YES
7	My Account	YES	YES
7.1	Profile	YES	YES
7.2	Change Password	YES	YES
7.3	Terms of service	YES	YES
7.4	Privacy policy	YES	YES
7.5	Rate the app	YES	YES
7.6	Logout	YES	YES
GO-JEK Services			
8	GO-PAY	YES	YES
8.1	Redeem	YES	YES
8.2	Top up	YES	YES
9	GO-RIDE	YES	YES
9.1	Set pickup location	YES	YES
9.2	Add note pickup location	YES	YES
9.3	Set destination location	YES	YES
9.4	Add note destination location	YES	YES
9.5	Order	YES	YES
10	GO-CAR	YES	YES
10.1	Set pickup location	YES	YES
10.2	Add note pickup location	YES	YES
10.3	Set destination location	YES	YES
10.4	Add note destination location	YES	YES
10.5	Order	YES	YES
11	GO-FOOD	YES	YES
11.1	Search	YES	YES
11.2	Near Me	YES	YES
11.3	Top Picks	YES	YES
11.4	Recommended Dishes	YES	YES
11.5	Explore	YES	YES
11.6	Suggest restaurant	YES	YES
11.7	Choosing food at one restaurant	YES	YES

No	Function	Actual Result	
		1.2 FCrct	1.3 FAppr
11.7.1	Choosing food menu	YES	YES
11.7.2	Order	YES	YES
12	GO-MART	YES	YES
12.1	Search	YES	YES
12.2	Delivery to	YES	YES
12.3	Choose category item	YES	YES
12.3.1	Choose item	YES	YES
12.3.2	Order	YES	YES
13	GO-SEND	YES	YES
13.1	From Pick location	YES	YES
13.2	Location detail	YES	YES
13.3	Contact person	YES	YES
13.4	To Pick location	YES	YES
13.5	Location detail	YES	YES
13.6	Contact person	YES	YES
13.7	Items to deliver	YES	YES
13.8	Order	YES	YES
14	GO-BOX	YES	YES
14.1	Choosing a car	YES	YES
14.1.1	Origin location	YES	YES
14.1.2	Location detail	YES	YES
14.1.3	Contact person	YES	YES
14.1.4	Instruction	YES	YES
14.1.5	Destination location	YES	YES
14.1.6	Location detail	YES	YES
14.1.7	Contact person	YES	YES
14.1.8	Instruction	YES	YES
14.1.9	Items to deliver	YES	YES
14.1.10	Extra features	YES	YES
14.1.11	Insurance	YES	YES
14.1.12	Booking time	YES	YES
14.1.13	Next	YES	YES
15	GO-MASSAGE	YES	YES
15.1	FAQ	YES	YES
15.2	Book now	YES	YES
15.2.1	Next 1	YES	YES
15.2.2	Back	YES	YES
15.2.3	Next 2	YES	YES
15.2.4	Validate	YES	YES
15.2.5	Back 2	YES	YES
15.2.6	Order	YES	YES

No	Function	Actual Result	
		1.2 FCrct	1.3 FAppr
16	GO-CLEAN	YES	YES
16.1	FAQ	YES	YES
16.2	Book now	YES	YES
16.2.1	Next 1	YES	YES
16.2.2	Back 1	YES	YES
16.2.3	Next 2	YES	YES
16.2.4	Validate	YES	YES
16.2.5	Back 2	YES	YES
16.2.6	Order	YES	YES
17	GO-GLAM	YES	YES
17.1	First time user	YES	YES
17.2	Home	YES	YES
17.2.1	Validate	YES	YES
17.2.2	See services	YES	YES
17.2.3	Book now	YES	YES
17.2.4	Choose from our featured talents	YES	YES
17.2.5	Order	YES	YES
18	GO-TIX	YES	YES
18.1	Events	YES	YES
18.1.1	Search	YES	YES
18.1.2	Choosing event	YES	YES
18.1.3	Next	YES	YES
18.1.4	Purchase	YES	YES
18.2	Movies	YES	YES
18.2.1	Search	NO	NO
18.2.2	Choosing movie	YES	YES
18.2.3	Pick seat	YES	YES
18.2.4	Review order	YES	YES
18.2.5	Order	YES	YES
19	GO-BUSWAY	YES	YES
19.1	Search	YES	YES
19.2	Go to this shelter	YES	YES
19.3	Request GO-JEK	YES	YES

Based on the results of testing sub characteristic Functional correctness and Functional appropriateness on Android devices in the table above, the percentage of sub characteristic Functional correctness and Functional appropriateness could be identified as the sum total is 112 functions:

- 1.2 FCrct : sub characteristic functional correctness

$$Yes = \frac{110}{112} x100\% = 98.2\%$$

$$No = \frac{2}{112} x100\% = 1.8\%$$

- 1.3 FAppr : sub characteristic functional appropriateness

$$Yes = \frac{110}{112} x100\% = 98.2\%$$

$$No = \frac{2}{112} x100\% = 1.8\%$$

- Total functional correctness dan functional appropriateness

$$FCrctFAppr = \frac{FCrct + FAppr}{TotSubcharacteristics} = \frac{98.2\% + 98.2\%}{2} = 98.2\%$$

Sub characteristic Functional correctnessand Functional Appropriateness above, results are compared with the table 3.19 Values Quality indicators are functional suitability table quality standards developed by Mioses Rodriguez [25]. The results were 98.2%, that is at the level 5 with a range of 81% - 100%. This indicates that the application GO-JEK has a very good quality of the functional correctness and functional appropriateness.

Based on the test results the following sub characteristic above are a summary of the results of testing for functional suitability characteristic described in the following table.

Table 4.8: Testing Result of Characteristic Functional Suitability on Android Device

No	Subcharacteristics	Result	Level	Predicate
1	Functional Correctness	81.81%	5	Very Good
2	Functional Correctness	98.2%	5	Very Good
3	Functional Appropriateness	98.2%	5	Very Good

4.3.2 Characteristic Performance Effeciency Testing

Testing the characteristic performance efficiency is made on three sub characteristic there are time behavior, resource utilization and capacity. Further explanation as follows.

1. Subcharacteristics Time Behavior

Testing sub characteristic time behavior is done by calculating the average response time of each function. Tests carried out three times using Biznet wifi connection with a service speed of 10 Mbps. The internet speed was

also tested at http://www.speedtest.net/id/ which shows speed internet for download is 9.28 Mbps and upload speed is 9.80 Mbps. The results of the testing of sub characteristic time behavior can be seen in the following table.

Table 4.9: Testing Result of Subcharacteristic Time Behavior on Android Device

No	Function	Response time (seconds), Testing:		
		1^{st}	2^{nd}	3^{rd}
1	Open GO-JEK (Never Sign Up)	6.40	5.59	6.01
2	Sign In	1.33	1.02	2.04
3	Forget Password	2.06	1.59	2.45
3.1	Reset password	1.53	1.01	2.02
4	Sign up	1.21	2.03	1.54
Menu in GO-JEK App				
5	History	2.66	2.12	2.40
5.1	In progress	1.23	1.32	2.23
5.2	Completed	1.55	1.29	2.20
6	Help	1.06	2.01	1.30
7	My Account	1.01	1.02	1.00
7.1	Profile	1.00	1.06	1.09
7.2	Change Password	1.21	1.30	2.00
7.3	Terms of service	10.88	9.23	11.00
7.4	Privacy policy	3.05	3.09	2.59
7.5	Rate the app	8.98	8.29	9.01
7.6	Logout	2.03	1.56	1.00
GO-JEK Services				
8	GO-PAY	1.60	1.52	1.34
8.1	Redeem	2.44	1.23	1.50
8.2	Top up	3.30	3.40	3.41
9	GO-RIDE	2.53	3.00	3.24
9.1	Set pickup location	1.21	1.00	1.09
9.2	Add note pickup location	1.02	1.29	1.57
9.3	Set destination location	2.71	2.65	3.01
9.4	Add note destination location	1.03	1.01	1.32
9.5	Order	9.26	10.00	10.23

No	Function	Response time (seconds), Testing:		
		1^{st}	2^{nd}	3^{rd}
10	GO-CAR	2.75	2.08	2.90
10.1	Set pickup location	1.23	1.09	1.00
10.2	Add note pickup location	1.02	1.00	1.21
10.3	Set destination location	1.56	1.03	1.90
10.4	Add note destination location	1.09	1.89	2.00
10.5	Order	10.11	11.05	10.59
11	GO-FOOD	2.91	3.02	2.40
11.1	Search	2.61	2.00	2.35
11.2	Near Me	3.08	3.90	2.89
11.3	Top Picks	3.78	3.07	3.90
11.4	Recommended Dishes	1.40	1.67	1.23
11.5	Explore	1.01	1.02	1.01
11.6	Suggest restaurant	1.06	1.00	1.23
11.7	Choosing food at one restaurant	2.38	2.60	2.34
11.7.1	Choosing food menu	1.86	1.45	1.39
11.7.2	Order	13.45	12.90	13.02
12	GO-MART	4.16	4.78	5.00
12.1	Search	7.09	6.89	6.56
12.2	Delivery to	1.38	1.34	1.20
12.3	Choose category item	2.11	2.05	1.56
12.3.1	Choose item	2.60	2.90	2.34
12.3.2	Order	14.19	15.00	14.67
13	GO-SEND	1.91	2.04	1.21
13.1	From Pick location	2.01	2.45	3.00
13.2	Location detail	1.04	1.00	1.21
13.3	Contact person	1.33	1.50	1.98
13.4	To Pick location	2.56	2.11	3.01
13.5	Location detail	1.02	2.31	2.52
13.6	Contact person	1.45	1.21	1.01
13.7	Items to deliver	1.56	1.02	2.02
13.8	Order	15.23	11.90	13.45
14	GO-BOX	2.16	3.01	2.54
14.1	Choosing a car	2.46	2.34	2.11
14.1.1	Origin location	1.33	1.45	2.23
14.1.2	Location detail	1.09	1.89	2.04
14.1.3	Contact person	1.76	2.56	1.01
14.1.4	Instruction	1.22	1.32	1.45
14.1.5	Destination location	1.44	1.42	1.33
14.1.6	Location detail	1.21	2.25	2.21

No	Function	Response time (seconds), Testing:		
		1^{st}	2^{nd}	3^{rd}
14.1.7	Contact person	2.30	2.30	2.12
14.1.8	Instruction	1.09	1.02	2.11
14.1.9	Items to deliver	2.33	2.24	2.01
14.1.10	Extra features	1.43	1.45	1.23
14.1.11	Insurance	1.02	1.01	1.33
14.1.12	Booking time	1.00	1.09	1.45
14.1.13	Next	20.54	15.90	16.78
15	GO-MASSAGE	5.35	6.78	7.00
15.1	FAQ	1.15	2.09	2.00
15.2	Book now	1.30	1.66	1.99
15.2.1	Next 1	1.06	1.05	1.00
15.2.2	Back	1.01	1.09	1.87
15.2.3	Next 2	1.23	1.06	2.00
15.2.4	Validate	6.34	7.00	7.21
15.2.5	Back 2	2.21	2.13	2.90
15.2.6	Order	15.09	15.99	16.00
16	GO-CLEAN	2.36	2.49	2.50
16.1	FAQ	1.11	2.00	2.12
16.2	Book now	1.28	1.34	1.45
16.2.1	Next 1	1.16	1.21	1.34
16.2.2	Back 1	1.44	1.88	1.76
16.2.3	Next 2	1.39	1.32	1.45
16.2.4	Validate	6.40	6.70	6.56
16.2.5	Back 2	2.29	3.01	1.87
16.2.6	Order	17.09	15.06	13.45
17	GO-GLAM	6.55	7.02	7.67
17.1	First time user	1.46	1.50	1.05
17.2	Home	1.30	1.33	1.21
17.2.1	Validate	1.06	1.01	1.01
17.2.2	See services	1.78	1.76	2.20
17.2.3	Book now	1.23	1.06	1.24
17.2.4	Choose from our featured talents	2.11	2.10	3.19
17.2.5	Order	21.09	15.89	18.00
18	GO-TIX	9.28	5.53	8.90
18.1	Events	1.71	2.81	2.31
18.1.1	Search	2.11	1.09	1.03
18.1.2	Choosing event	1.83	1.90	1.45

No	Function	Response time (seconds), Testing:		
		1^{st}	2^{nd}	3^{rd}
18.1.3	Next	4.01	5.43	4.32
18.1.4	Purchase	11.09	10.78	9.33
18.2	Movies	1.35	1.87	2.34
18.2.1	Search	2.01	1.57	1.02
18.2.2	Choosing movie	2.56	2.07	2.04
18.2.3	Pick seat	2.45	2.56	3.00
18.2.4	Review order	6.98	6.97	4.76
18.2.5	Order	10.12	11.23	15.02
19	GO-BUSWAY	5.88	4.01	4.56
19.1	Search	1.46	1.90	2.07
19.2	Go to this shelter	2.86	1.67	1.04
19.3	Request GO-JEK	2.08	1.06	1.78
Average		3.53	3.43	3.60
Total of Average		3.52		

Results of testing the sub characteristic time behavior get an average response time of 3.52 seconds. These results are compared with the table which is a table 3.20 User Satisfaction Measurement [14]. After comparison, these results are at level 4 with the predicate of "Satisfied" with a range of 3-9 seconds. This indicates that the application GO-JEK have good quality in the sub characteristic time behavior.

2. Subcharacteristics Resource Utilization

Testing sub characteristics resource utilization is done by observing the processing resources when the application is used. The results of the observation of the use of memory when an application installs and when the application is run are as follows.

Table 4.10: Testing Result of Subcharacteristic Resource Utilization on Android Device

Transportation Service Application	Android	
	Instalation	Running
GO-JEK	23.92 MB	40.80 MB

Based on the observation table above, results compared to indicators of resource utilization table. Table indicator of resource utilization was made by author based on observation of several transportation service application that is similar to GO-JEK and had a rating above 3.5 scale 5. The application were GRAB, UBER and My Bluebird. The results were 23.92 MB for instalation and 40.80 MB for running is located on level 4 with a range of 21-24 MB for the

instalation and 36-42 MB for Running. This indicates that the application gojek have good quality in sub characteristics resource utilization.

3. Subcharacteristics Capacity

Testing result sub characteristic capacity is done by observing the maximum limit of GO-JEK application when processing multiple orders. The results of these observations are described in the following table.

Table 4.11: Testing Result of Subcharacteristic Capacity on Android Device

No	Test Case	Actual Case	Actual Result
1	Booked multiple orders with one of GO-JEK service.	Booked multiple orders GO-RIDE 7 times.	Applications can process all orders well.
2	Booked multiple orders with some of GO-JEK service.	Booked multiple order GO-CAR and GO-FOOD	Applications can process all orders well.
3	Add items into the shopping cart as many as 100 items when using the GO-MART.	Add items from Alfamart store into a shopping cart as many as 100 items.	Applications GOJEK can add items to the shopping cart more than 100 items.
4	Adding food in a shopping cart of 100 items when using the GO-FOOD.	Adding food in resto HokBen in a shopping basket of 100 items	Applications can add items to the shopping cart more than 100 items.

Based on the observation table above, the results compared with a table capacity indicator. Table capacity indicator was made by author based on observation of the features in the application GO-JEK about capacity and application capabilities to the limit. The results of these observations are "All testcase in accordance with the expectation result" which is located at level 5. This indicates that the application GO-JEK has a very high capacity.

Based on the test results the following sub characteristics above is a summary of test results for characteristic effeciency performance outlined in the following table.

Table 4.12: Testing Result of Characteristic Performance Effeciency on Android Device

No	Subcharacteristics	Result	Level	Predicate
1	Time Behavior	3.52 second	4	Satisfied
2	Resource Utilization	23.92 MB Instalation 40.80 MB Running	4	Good
3	Capacity	All testcase in accordance with the expectation result	5	Very High Capacity

4.3.3 Characteristic Compatibility Testing

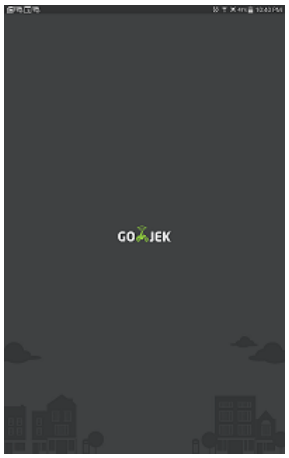
In accordance with the research instrument and data analysis techniques described in the previous chapter, the test for compatibility characteristics is divided into two sub-characteristics, there are sub characteristics co-existence and interoperability. For further explanation is as follows.

1. Subcharacteristics Co-Existence

Co-existence testing intended to determine the ability of an application running on the certain device and operating system. Here is the results of testing sub characteristic co-existence based on the scenario testing test plan which has been described in previous chapters.

Table 4.13: Testing Result of Subcharacteristic Co-Existence

No	Scenario testing	Device specifications	Capture	Actual Result
1	Install at least 4.0 android device, screen <6 inch.	Sony Experia SP, Android 4.3 Jelly Bean, Screen 4.6 inch.		YES, instalation success.

No	Scenario testing	Device specifications	Capture	Actual Result
2	Running GO-JEK features on android device at least 4.0, screen < 6 inch.	Sony Experia SP, Android 4.3 Jelly Bean, Screen 4.6 inch.		YES, it can running well.
3	Install at least 4.0 android device, screen >6 inch.	Samsung Galaxy Tab S (SM-T705), Android 5.0.2 Lollipop, Screen 8.4 inch.		YES, instalation success.
4	Running GO-JEK features on android device at least 4.0, screen >6 inch.			YES, it can running well.

No	Scenario testing	Device specifications	Capture	Actual Result
5	Install at least 7.0 iOS device, screen <6 inch.	Apple iPhone 5s, iOS 9.3, Screen 4 inch.		YES, instalation success.
6	Running GO-JEK features on iOS device at least 7.0, screen <6 inch.			YES, it can running well.
7	Install at least 7.0 iOS device, screen >6 inch.	Apple iPad Air, iOS 10.0, Screen 9.7 inch.		YES, instalation success.

No	Scenario testing	Device specifications	Capture	Actual Result
8	Running GO-JEK features on iOS device at least 7.0, screen >6 inch.	Apple iPad Air, iOS 10.0, Screen 9.7 inch.		YES, it can running well.

Based on the observation table above, the results compared to the indicator table co-existence. Table indicator of co-existence was made by author based on observation of the ability of the application when running with different devices and operating systems. The results of these observations are "All the test results in accordance with the expectation result" which is located at level 5. This suggests that the co-existence GO-JEK applications very well.

2. Subcharacteristics Interoperability

Interoperability testing is intended to determine the ability of an application exchanging information with other systems. Here are the results of interoperability testing of sub characteristics test plan based scenario testing that has been described in previous chapters.

Table 4.14: Test Plan for Subcharacteristic Interoperability Testing on Android Device

No	Test Case	Actual Results
1	Enter your name and phone number from a contact when booking process available in the phone user.	YES, success to access the contacts and success to enter the name and phone number on the data from the contact in phone.
2	Call driver	YES, success to display a number of calls to the driver automatically.

No	Test Case	Actual Results
3	SMS driver	YES, sucess to display the menu screen message that ready to send a message to the number of driver.
4	Call Support	NO, failed to make a call to customer service GOJEK automatically, because the call support provides the option to write a message or a call proceeding.
5	Rate this App	YES, success to access GOJEK in PlayStore / Appstore to rate the app.
6	Forget password	YES, success to send a password reset email that was written to the user.
7	Maps	YES, sucess to display Google Maps.

Based on the observation table above, the results compared with the indicator table interoperability. Table indicator of interoperability is made by the author based on observation of the application when the ability to exchange information with other applications or systems. The results of these observations is "There is 1-2 testcase that does not accordance with the expectation result" which is located at level 4. This shows that the GO-JEK application interoperability is good.

Based on the above test results sub characteristic, The summary of test results for Compatibility characteristic outlined in the following table.

Table 4.15: Testing Result of Characteristic Compatibility on Android Device

No	Subcharacteristics	Result	Level	Predicate
1	Co-Existence	All the test results in accordance with the expectation result	5	Very Good
2	Interoperability	There is 1-2 testcase that does not accordance with the expectation result	4	Good

4.3.4 Characteristic Usability Testing

Measurement the characteristic usability aims to ensure the application GO-JEK is easy to use or access and can give satisfaction. Testing this characteristic is based on the user's perspective, because it is considered to be more objective results. Before the questionnaires distributed, tested the validity and reliability of the 30 respondents. Validity and reliability result is as follows.

4.3.4.1 Validity Results

The validity result can be seen by using the Pearson Correlation value between each variable item with the variable it self. The minimum number of Pearson correlation value to be valid for the research is 0,3610[27]. It refers to Table R by using the value of signicance level at 5% with 30 number of sample [27].

Below is the validity test result from characteristic usability instrument.

Table 4.16: Validity Result from Characteristic Usability Instrument

Instrument	Pearson Correlation $r_{hitung}(r_{xy})$	R Table r_{table}	Significance Level	Validity
Apr	1.000**	0,3610	0.01	Valid
Lrn01	0.899**	0,3610	0.01	Valid
Lrn02	0.918**	0,3610	0.01	Valid
Opr01	0.822**	0,3610	0.01	Valid
Opr02	0.770**	0,3610	0.01	Valid
UEr01	0.909**	0,3610	0.01	Valid
UEr02	0.803**	0,3610	0.01	Valid
UIA01	0.796**	0,3610	0.01	Valid
UIA02	0.823**	0,3610	0.01	Valid
Acs01	0.897**	0,3610	0.01	Valid
Acs02	0.908**	0,3610	0.01	Valid

Description:

- Apr = Appropriateness Recognizability
- Lrn = Learnability
- Opr = Operability
- UEr = User Error Protection

- UIA = User Interface Aesthetics
- Acs = Accessibility

Based on the validity of the instrument usability test results in Table 4.16 there were 11 instruments were tested and showed that all the instruments declared "valid" with Pearson Correlation or $r_{hitung}(r_{xy})$ has a value greater than R table or r_{table}. It shows all the instruments that are measured in usability characteristic produce accurate data and reliable with a minimum standard of value $r_{hitung}(r_{xy})$ is 0,3610 and a confidence level is 99%.

4.3.4.2 Reliabilty Results

After tested the validity, the next stage is the reliability test on each variable. Reliability tests conducted to measure the accuracy and consistency of scores on any instrument that has been filled by the respondent. The accuracy and consistency of scores known from the value of Cronbach-Alpha converted into the category of reliability coefficient. The following table is the result of reliability testing on usability aspects.

Table 4.17: Reliabilty Result from Characteristic Usability Instrument

Instrument	Cronbach Alpha	Reliabilty
Apr	1.000	Reliable
Lrn01	0.929	Reliable
Lrn02	0.929	Reliable
Opr01	0.808	Reliable
Opr02	0.808	Reliable
UEr01	0.874	Reliable
UEr02	0.874	Reliable
UIA01	0.825	Reliable
UIA02	0.825	Reliable
Acs01	0.924	Reliable
Acs02	0.924	Reliable

Table 4.17 shows there are 11 items instrument usability characteristic and generate Cronbach Alpha value of the average is above 0.8. Based on Reliability Index Criteria[27], all instruments are tested on usability characteristic generate data with high reliability or consistency. This shows that all instruments are measured generate trustworthy data.

4.3.4.3 Questionnaire Usability Results

After tested the validity and reliability of questionnaires to 30 people and the results show that all the items on the questionnaire is valid and reliable, questionnaires were distributed to 100 respondents were sampled with the criteria described in the previous chapter. The following are the results of the questionnaire based on the answers of respondents to characteristic usability.

Table 4.18: Response from Respondents Usability Questionnaire

Instrument	Frequency Response from Respondents					Total Respondents	Modus
	STS	TS	N	S	SS		
Apr	2	1	13	48	36	100	S
Lrn01	1	4	2	57	36	100	S
Lrn02	1	3	1	52	43	100	S
Opr01	2	1	8	59	30	100	S
Opr02	3	2	20	54	21	100	S
UEr01	1	11	47	31	10	100	N
UEr02	3	8	58	23	8	100	N
UIA01	0	4	12	63	21	100	S
UIA02	0	9	26	53	12	100	S
Acs01	6	9	29	37	19	100	S
Acs02	3	9	19	49	20	100	S

After obtained the results as the table above, the scale is calculated using a formula that has been described in previous chapters to get the value feasibility of characteristic usability. The calculations described in the following table.

Table 4.19: Usability Testing Results

Interpretation	Total (I)	Likert Scale (S)	IxS
STS	22	1	22
TS	61	2	122
N	235	3	705
S	526	4	2104
SS	256	5	1280
Total $\sum IxS$			4233
Maximum value $MaxU$			5500

Furthermore, do the calculations to obtain test results usability characteristic. The calculations are as follows.

$$\frac{\sum IxS}{MaxU} x100\% = \frac{4233}{5500} x100\% = 76.97\%$$

Based on the above calculation, the results of testing for usability is 76.97% then compared with indicators of usability score interpretation table. Results of testing the usability characteristic are at level 4 with a range of 61% - 80%. Meanwhile, the table Response from Respondents, mode or answers that have frequencies that often arises is agree or "S". These things demonstrate the ability of GO-JEK applications for its use is within the criteria of usability is Good.

4.3.5 Characteristic Reliability Testing

In accordance with the research instrument and data analysis techniques described in the previous chapter, the test for characteristic reliability is based on observations of the functions related to the application reliability when used in certain conditions. In testing characteristic reliability, there is one subcharacteristic that is maturity with further explanation as follows.

1. Subcharacteristics Maturity

Maturity testing aims to ensure the application GO-JEK can survive from the failure or software error. Here are the results of testing sub maturity characteristic test plan based scenario testing that has been described in previous chapters.

Table 4.20: Testing Result of Subcharacteristic Maturity on Android Device

No	Test Case	Actual Result	
1	Turning off the the Internet connection with disable data packet or wifi when ordering process GO-JEK service.	YES	The booking process was not continued and application GO-JEK provide notification there is no internet access.

No	Test Case	Actual Result	
2	Turning on airplane mode when you're ordering process GO-JEK service.	NO	The system only gives notification booking error and did not give notification that airplane mode is on, turn off to continue the process
3	Running multiple applications to use a lot of RAM usage, and then run the GO-JEK application.	YES	GO-JEK application continues to run and can be used with the processing time of less than 7.44 seconds.
4	Giving too many instructions such as requesting many functions almost simultaneously.	YES	GO-JEK applications can continue to run even if the processing wait time longer than normal.

Based on the observation table above, the results compared with a maturity indicator table. The results of these observations are "There are 3 testcase in accordance with expectation result." Which is located at level 4. This suggests that the ability of GO-JEK applications for defense applications of failures or errors is high.

Based on the test results the following sub above characteristics is the summary of the test results for the Reliability characteristic described in the following table.

Table 4.21: Testing Result of Characteristic Reliability on Android Device

No	Subcharacteristics	Result	Level	Predicate
1	Maturity	There are 3 testcase in accordance with expectation result.	4	Defense applications of failures or errors is high.

4.3.6 Characteristic Security Testing

In accordance with the research instrument and data analysis techniques described in the previous chapter, testing for security characteristic is divided into five sub karakteridtik, there are sub characteristic confidentiality,

integrity, non-repudiation, accountability and authenticity. For further explanation is as follows.

1. Subcharacteristics Confidentiality

Confidentiality testing aimed at determining if the application GO-JEK capable of providing protection permissions on each user. Here are the results of testing sub characteristic confidentiality based scenario testing test plan which has been described in previous chapters.

Table 4.22: Testing Result of Subcharacteristic Confidentiality on Android Device

No	Test Case	Actual Results	$scoreQ_n$
1	Filling the registration data by clearing the data one field.	GO-JEK application leave empty message fields must be filled.	1
2	Filling the registration data with a password that is short or less than 5 characters.	GO-JEK application displays an error message data is password too short "At least eight character".	1
3	Filling the registration data with the name field of one character.	GO-JEK processing registration applications with the name of one character of data.	0
4	Filling the registration data with passwords containing only character.	GO-JEK application displays an error message "Password must be alphanumeric".	1
5	Fill data to confirm the password field is different from the password data to be used.	GO-JEK application displays an error message "Password confirmation does not match the password".	1
6	Filling the registration data with email address is incomplete.	GO-JEK application displays an error message "Email must be in the format: name@email.com"	1
7	Filling the registration data by using an email address that has been used.	GO-JEK application displays an error message “Email has already been taken”	1

Based on the above table are calculated sub characteristic confidentiality testing with Goal-Question- Metrics (GQM) as follows.

$$SS_{confidentiality} = \frac{1+1+0+1+1+1+1}{7} x100\% = 85.71\%$$

The results of these observations is 85.71% which is at level 5. This

indicates that the GO-JEK application's ability to protect access to users is very high.

2. Subcharacteristics Integrity

Testing the integrity is intended to ensure the application GO-JEK able to prevent permissions are not allowed to enter into the system. Here are the results of testing sub integrity characteristic based scenario testing test plan which has been described in previous chapters.

Table 4.23: Testing Result of Subcharacteristic Integrity on Android Device

No	Test Case	Actual Results	$scoreQ_n$
1	Login: a. Username filled with incorrect data. b. Password is filled with the correct data.	GO-JEK application displays an error message "Customer not found".	1
2	Login: a. Username filled with correct data. b. Password is filled with the incorrect data.	GO-JEK application displays an error message "Email and password don't match".	1
3	Request for reset password	GO-JEK application sends a message to the email for reset password.	1
4	Login with incorrect data more than three times.	Applications GO-JEK block account for 30 minutes.	1
5	Do not open the application more than one week.	GO-JEK application displays home page and not has to log in first.	0

Based on the above table are calculated the sub characteristic integrity testing with Goal-Question- Metrics (GQM) as follows.

$$SS_{integrity} = \frac{1+1+1+1+0}{5} x100\% = 80\%$$

The results of these observations is 80%, which is at the level 4. This suggests that the ability of an application to prevent unauthorized access is high.

3. Subcharacteristics Non-repudiation

Testing non-repudiation is intended to ensure the application GO-JEK able to provide evidence of acts or transactions performed by the user. Here are the results of testing sub characteristics non-repudiation test plan based scenario testing that has been described in previous chapters.

Table 4.24: Testing Result of Subcharacteristic Non-repudiation on Android Device

No	Test Case	Actual Results	$scoreQ_n$
1	User registration via the GO-JEK application.	Applications GO-JEK provide proof of enrollment registration via email.	1
2	Reservations service GO-JEK through the application.	Booking list can be seen in the history menu at complete order.	1
3	Cancellation order service GOJEK through the application.	Booking list can be seen in the history menu at canceled order.	1
4	The booking process has been completed.	GO-JEK application does not provide proof of payment or transaction ordering and billing via email.	0

Based on the table testing above sub characteristics non-repudiation calculated by Goal-Question- Metrics (GQM) as follows.

$$SS_{non-repudiation} = \frac{1+1+1+0}{4} x100\% = 75\%$$

The results of these observations is 75% which is at level 4. This suggests that the ability of the application to give evidence to the actions / transactions performed by users is high.

4. Subcharacteristics Accountability

Testing sub characteristic accountability is intended to ensure the application GO-JEK capable of being able to track all activities or activities performed by the user. Here are the results of testing sub characteristic accountability based scenario testing test plan which has been described in previous chapters.

Table 4.25: Testing Result of Subcharacteristic Accountability on Android Device

No	Test Case	Actual Results	$scoreQ_n$
1	Open the history order menu.	The system provides information reservation made by the user, such as time and date and details of service booked or canceled by the user.	1
2	Search	The system provides information search results that have been done by the user.	1
3	Leave a comment or rating for service driver, beautician, cleaner or masseur.	The rating system provides a list of information or comment that has been given by the user.	0
4	Top up	The system provides information of charging and discharging a list of credit balances.	0.5

Based on the testing table above is calculated by sub characteristic accountability Goal-Question- Metrics (GQM) as follows.

$$SS_{accountability} = \frac{1+1+0+0.5}{4} x100\% = 62.5\%$$

The results of these observations is 62.5% which is at level 4. This suggests that the ability of application to track of events / activities that have been performed by the user is high.

5. Subcharacteristics Authenticity

Testing sub characteristic Authenticity is intended to ensure the application GO-JEK application is able to provide confirmation of the authenticity of the user data. Here are the results of testing sub characteristic Authenticity by scenario testing test plan which has been described in previous chapters.

Table 4.26: Testing Result of Subcharacteristic Authenticity on Android Device

No	Test Case	Actual Results	$scoreQ_n$
1	Register user data	Aplikasi GO-JEK sends a verification code via email or SMS	1
2	Login on multiple devices without logout first.	Aplikasi GO-JEK does not display information that account was logged in on other devices, and the user can log on another device without having to first log out the previous device.	0
3	Changing the password by filling the field for the old password, the new password, confirm the new password.	The password change was successful.	1
4	Replace the data in the account.	Update data successfully performed and account data successfully replaced.	1

Based on the testing table above is calculated by subkarakteristik Authenticity Goal-Question- Metrics (GQM) as follows.

$$SS_{authenticity} = \frac{1+0+1+1}{4} x100\% = 75\%$$

The results of these observations is 75% which is at level 4. This suggests that the ability of the application to confirm the authenticity of the user data is high.

Based on the test results of five sub characteristics, namely the Confidentiality, Integrity, Non-repudiation Accountability, Authenticity above the following is a summary of the results of testing for security characteristic outlined in the following table.

Table 4.27: Testing Result of Characteristic Security on Android Device

No	Subcharacteristics	Result	Level	Predicate
1	Confidentiality	85.71%	5	GOJEK application capability to gives the user access protection is very high.
2	Integrity	80%	4	GOJEK application capability to prevent unauthorized access is high.
3	Non-repudiation	75%	4	GOJEK application capability to give evidence to the actions / transactions performed by users is high.
4	Accountability	62.5%	4	GOJEK application capability to track of events / activities that have been performed by the user is high.
5	Authenticity	75%	4	GOJEK application capability to confirm the authenticity of the user data is high.

4.4 Product Quality Measurement of Transportation Service Application GO-JEK on iOS Device

Transportation service application GO-JEK tested every characteristic to obtain quantitative quality value. Here are the results of testing GO-JEK with a mobile device type iPhone 5s operating system iOS.

4.4.1 Characteristic Functional Suitability Testing

In accordance with the research instrument and data analysis techniques described in the previous chapter, the characteristics of functional suitability, there are 3 sub-characteristics which has two sub test plan, to test the sub characteristics functional completeness and test plan to test sub characteristics functional correctness and functional appropriateness.

1. Subcharacteristics Functional Completeness

The following table are the test results for sub characteristic functional completeness.

Table 4.28: Test results for Sub characteristics Functional Completeness on iOS Device

No	Fungtion	Actual Result
1	Login with social media	NO
2	User registration	YES
3	Pick up location based on GPS	YES
4	Pick up location by input	YES
5	Destination location by input	YES
6	Location history/ frequent location	YES
7	Determine the path of the journey	NO
8	Notes	YES
9	Contact driver	YES
10	Notification for finding driver	YES
11	Driver details information	YES
12	Tracking arrival status	YES
13	Multiple order	YES
14	Share journey	NO
15	Cancel booking	YES
16	Feedback for rating rider	YES
17	Fungsi Wallet/Credit	YES
18	Account	YES
19	History order	YES
20	E-Receipt	NO
21	Help menu	YES
22	Call Support	YES

Based on the results of testing sub characteristic functional completeness on Android devices in the table above, the percentage of sub characteristic functional completeness could be identified as the total number of completeness functions are 22:

$$Yes = \frac{18}{22} x100\% = 81.81\%$$

$$No = \frac{4}{22} x100\% = 18.19\%$$

From the calculations above sub characteristic functional completeness, results are compared with the table 3.18 indicator of functional completeness. The results were 81.81%, ie at the level 5 with a range of 81% - 100%. This indicates that the application GO-JEK has a very good quality of the functional completeness.

2. Subcharacteristics Functional Correctness dan Functional Appropriateness

The following table are the test results for sub characteristic functional correctness and functional appropriateness. Answer "YES" if the actual result in accordance with expectations, and answer "NO" if the actual result is not in accordance with expectations.

Table 4.29: Testing Result of Subcharacteristic Functional Correctness dan Functional Appropriateness on iOS Device

No	Function	Actual Result	
		1.2 FCrct	1.3 FAppr
1	Open GO-JEK (Never Sign Up)	YES	YES
2	Sign In	YES	YES
3	Forget Password	YES	YES
3.1	Reset password	YES	YES
4	Sign up	YES	YES
Menu in GO-JEK App			
5	History	YES	YES
5.1	In progress	YES	YES
5.2	Completed	YES	NO
6	Help	YES	YES
7	My Account	YES	YES
7.1	Profile	YES	YES
7.2	Change Password	YES	YES
7.3	Terms of service	YES	YES
7.4	Privacy policy	YES	YES
7.5	Rate the app	YES	YES
7.6	Logout	YES	YES
GO-JEK Services			
8	GO-PAY	YES	YES
8.1	Redeem	YES	YES
8.2	Top up	YES	YES
9	GO-RIDE	YES	YES
9.1	Set pickup location	YES	YES
9.2	Add note pickup location	YES	YES
9.3	Set destination location	YES	YES
9.4	Add note destination location	YES	YES
9.5	Order	YES	YES

No	Function	Actual Result	
		1.2 FCrct	1.3 FAppr
10	GO-CAR	YES	YES
10.1	Set pickup location	YES	YES
10.2	Add note pickup location	YES	YES
10.3	Set destination location	YES	YES
10.4	Add note destination location	YES	YES
10.5	Order	YES	YES
11	GO-FOOD	YES	YES
11.1	Search	YES	YES
11.2	Near Me	YES	YES
11.3	Top Picks	YES	YES
11.4	Recommended Dishes	YES	YES
11.5	Explore	YES	YES
11.6	Suggest restaurant	YES	YES
11.7	Choosing food at one restaurant	YES	YES
11.7.1	Choosing food menu	YES	YES
11.7.2	Order	YES	YES
12	GO-MART	YES	YES
12.1	Search	YES	YES
12.2	Delivery to	YES	YES
12.3	Choose category item	YES	YES
12.3.1	Choose item	YES	YES
12.3.2	Order	YES	YES
13	GO-SEND	YES	YES
13.1	From Pick location	YES	YES
13.2	Location detail	YES	YES
13.3	Contact person	YES	YES
13.4	To Pick location	YES	YES
13.5	Location detail	YES	YES
13.6	Contact person	YES	YES
13.7	Items to deliver	YES	YES
13.8	Order	YES	YES
14	GO-BOX	YES	YES
14.1	Choosing a car	YES	YES
14.1.1	Origin location	YES	YES
14.1.2	Location detail	YES	YES
14.1.3	Contact person	YES	YES
14.1.4	Instruction	YES	YES
14.1.5	Destination location	YES	YES
14.1.6	Location detail	YES	YES
14.1.7	Contact person	YES	YES
14.1.8	Instruction	YES	YES
14.1.9	Items to deliver	YES	YES
14.1.10	Extra features	YES	YES

No	Function	Actual Result	
		1.2 FCrct	1.3 FAppr
14.1.11	Insurance	YES	YES
14.1.12	Booking time	YES	YES
14.1.13	Next	YES	YES
15	GO-MASSAGE	YES	YES
15.1	FAQ	YES	YES
15.2	Book now	YES	YES
15.2.1	Next 1	YES	YES
15.2.2	Back	YES	YES
15.2.3	Next 2	YES	YES
15.2.4	Validate	YES	YES
15.2.5	Back 2	YES	YES
15.2.6	Order	YES	YES
16	GO-CLEAN	YES	YES
16.1	FAQ	YES	YES
16.2	Book now	YES	YES
16.2.1	Next 1	YES	YES
16.2.2	Back 1	YES	YES
16.2.3	Next 2	YES	YES
16.2.4	Validate	YES	YES
16.2.5	Back 2	YES	YES
16.2.6	Order	YES	YES
17	GO-GLAM	YES	YES
17.1	First time user	YES	YES
17.2	Home	YES	YES
17.2.1	Validate	YES	YES
17.2.2	See services	YES	YES
17.2.3	Book now	YES	YES
17.2.4	Choose from our featured talents	YES	YES
17.2.5	Order	YES	YES
18	GO-TIX	YES	YES
18.1	Events	NO	NO
18.1.1	Search	YES	YES
18.1.2	Choosing event	YES	YES
18.1.3	Next	YES	YES
18.1.4	Purchase	YES	YES
18.2	Movies	YES	YES
18.2.1	Search	NO	NO
18.2.2	Choosing movie	YES	YES
18.2.3	Pick seat	YES	YES
18.2.4	Review order	YES	YES
18.2.5	Order	YES	YES

No	Function	Actual Result	
		1.2 FCrct	1.3 FAppr
19	GO-BUSWAY	YES	YES
19.1	Search	YES	YES
19.2	Go to this shelter	YES	YES
19.3	Request GO-JEK	YES	YES

Based on the results of testing sub characteristic Functional correctness and Functional appropriateness on Android devices in the table above, the percentage of sub characteristic Functional correctness and Functional appropriateness could be identified as the sum total is 113 functions:

- 1.2 FCrct : sub characteristic functional correctness

$$Yes = \frac{111}{113} x100\% = 98.23\%$$

$$No = \frac{2}{113} x100\% = 1.77\%$$

- 1.3 FAppr : sub characteristic functional appropriateness

$$Yes = \frac{110}{113} x100\% = 97.34\%$$

$$No = \frac{3}{113} x100\% = 2.66\%$$

- Total functional correctness dan functional appropriateness

$$FCrctFAppr = \frac{FCrct + FAppr}{TotSubcharacteristics} = \frac{98.23\% + 97.34\%}{2} = 97.78\%$$

Sub characteristic Functional correctnessand Functional Appropriateness above, results are compared with the table 3.19 Values Quality indicators are functional suitability table quality standards developed by Mioses Rodriguez [25]. The results were 97.78%that is at the level 5 with a range of 81% - 100%. This indicates that the application GO-JEK has a very good quality of the functional correctness and functional appropriateness.

Based on the test results the following sub characteristic above are a summary of the results of testing for functional suitability characteristic described in the following table.

Table 4.30: Testing Result of Characteristic Functional Suitability on iOS Device

No	Subcharacteristics	Result	Level	Predicate
1	Functional Correctness	81.81%	5	Very Good
2	Functional Correctness	97.78%	5	Very Good
3	Functional Appropriateness	97.78%	5	Very Good

4.4.2 Characteristic Performance Effeciency Testing

Testing the characteristic performance efficiency is made on three sub characteristic there are time behavior, resource utilization and capacity. Further explanation as follows.

1. Subcharacteristics Time Behavior

Testing sub characteristic time behavior is done by calculating the average response time of each function. Tests carried out three times using Biznet wifi connection with a service speed of 10 Mbps. The internet speed was also tested at http://www.speedtest.net/id/ which shows speed internet for download is 9.28 Mbps and upload speed is 9.80 Mbps. The results of the testing of sub characteristic time behavior can be seen in the following table.

Table 4.31: Testing Result of Subcharacteristic Time Behavior on iOS Device

No	Function	Response time (seconds), Testing:		
		1^{st}	2^{nd}	3^{rd}
1	Open GO-JEK (Never Sign Up)	2.05	2.33	2.21
2	Sign In	1.07	1.00	1.05
3	Forget Password	1.04	1.12	1.15
3.1	Reset password	1.30	1.13	1.27
4	Sign up	1.07	1.22	1.18
Menu in GO-JEK App				
5	History	1.02	1.05	1.01
5.1	In progress	1.05	1.03	1.04
5.2	Completed	1.06	1.11	1.06
6	Help	1.04	1.04	1.07

No	Function	Response time (seconds), Testing:		
		1^{st}	2^{nd}	3^{rd}
7	My Account	1.12	1.09	1.08
7.1	Profile	1.10	1.12	1.09
7.2	Change Password	1.08	1.14	1.10
7.3	Terms of service	3.25	3.21	3.32
7.4	Privacy policy	2.89	2.81	2.79
7.5	Rate the app	2.01	2.02	2.00
7.6	Logout	1.00	1.02	1.01
GO-JEK Services				
8	GO-PAY	1.00	1.01	1.03
8.1	Redeem	2.02	2.05	2.00
8.2	Top up	2.00	2.02	2.03
9	GO-RIDE	1.01	1.00	1.02
9.1	Set pickup location	2.03	2.01	2.01
9.2	Add note pickup location	1.01	1.00	1.00
9.3	Set destination location	2.05	2.05	2.09
9.4	Add note destination location	1.00	1.00	1.00
9.5	Order	8.21	8.22	8.19
10	GO-CAR	1.00	1.04	1.03
10.1	Set pickup location	2.00	2.03	2.00
10.2	Add note pickup location	1.00	1.01	1.00
10.3	Set destination location	2.03	2.03	2.05
10.4	Add note destination location	1.04	1.00	1.07
10.5	Order	8.31	8.33	8.30
11	GO-FOOD	1.02	1.01	1.03
11.1	Search	1.23	1.27	1.21
11.2	Near Me	3.25	3.26	3.22
11.3	Top Picks	2.65	2.69	2.65
11.4	Recommended Dishes	1.00	1.01	1.00
11.5	Explore	1.01	1.00	1.00
11.6	Suggest restaurant	1.02	1.00	1.00
11.7	Choosing food at one restaurant	1.98	1.99	1.97
11.7.1	Choosing food menu	2.41	2.45	2.48
11.7.2	Order	13.60	13.55	13.57
12	GO-MART	4.73	4.73	4.73
12.1	Search	5.33	5.33	5.33
12.2	Delivery to	1.20	1.20	1.20
12.3	Choose category item	3.04	3.04	3.04
12.3.1	Choose item	1.40	1.40	1.40
12.3.2	Order	9.66	9.66	9.66

No	Function	Response time (seconds), Testing:		
		1^{st}	2^{nd}	3^{rd}
13	GO-SEND	1.18	1.13	1.15
13.1	From Pick location	1.03	1.04	1.03
13.2	Location detail	1.00	1.02	1.01
13.3	Contact person	1.01	1.01	1.00
13.4	To Pick location	1.00	1.00	1.04
13.5	Location detail	1.02	1.01	1.00
13.6	Contact person	1.00	1.01	1.00
13.7	Items to deliver	1.01	1.01	1.00
13.8	Order	6.83	6.82	6.85
14	GO-BOX	1.01	1.01	1.00
14.1	Choosing a car	1.02	1.02	1.00
14.1.1	Origin location	1.00	1.03	1.04
14.1.2	Location detail	1.01	1.02	1.00
14.1.3	Contact person	1.00	1.00	1.02
14.1.4	Instruction	1.00	1.01	1.00
14.1.5	Destination location	1.00	1.00	1.00
14.1.6	Location detail	1.02	1.00	1.02
14.1.7	Contact person	1.03	1.00	1.00
14.1.8	Instruction	1.01	1.02	1.01
14.1.9	Items to deliver	1.00	1.01	1.02
14.1.10	Extra features	1.02	1.02	1.00
14.1.11	Insurance	1.03	1.05	1.02
14.1.12	Booking time	1.00	1.01	1.01
14.1.13	Next	9.87	9.84	9.82
15	GO-MASSAGE	2.75	2.73	2.77
15.1	FAQ	1.00	1.05	1.03
15.2	Book now	1.00	1.00	1.11
15.2.1	Next 1	1.56	1.58	1.56
15.2.2	Back	1.00	1.00	1.02
15.2.3	Next 2	1.44	1.47	1.45
15.2.4	Validate	1.00	1.00	1.00
15.2.5	Back 2	1.00	1.00	1.00
15.2.6	Order	10.54	10.55	10.52
16	GO-CLEAN	2.35	2.34	2.33
16.1	FAQ	1.00	1.01	1.02
16.2	Book now	1.00	1.02	1.01
16.2.1	Next 1	1.20	1.20	1.22
16.2.2	Back 1	1.00	1.00	1.01
16.2.3	Next 2	1.32	1.31	1.33
16.2.4	Validate	1.00	1.03	1.03
16.2.5	Back 2	1.00	1.00	1.01
16.2.6	Order	11.54	11.52	12.05

No	Function	Response time (seconds), Testing:		
		1^{st}	2^{nd}	3^{rd}
17	GO-GLAM	3.01	3.03	3.01
17.1	First time user	1.00	1.02	1.01
17.2	Home	1.02	1.02	1.00
17.2.1	Validate	4.61	4.60	4.63
17.2.2	See services	1.25	1.22	1.24
17.2.3	Book now	1.00	1.04	1.02
17.2.4	Choose from our featured talents	1.02	1.04	1.00
17.2.5	Order	11.02	11.02	11.04
18	GO-TIX	1.00	1.01	1.02
18.1	Events	1.55	1.51	1.52
18.1.1	Search	1.00	1.03	1.02
18.1.2	Choosing event	1.00	1.02	1.01
18.1.3	Next	2.13	2.15	2.14
18.1.4	Purchase	7.80	7.83	7.81
18.2	Movies	1.00	1.01	1.01
18.2.1	Search	1.00	1.01	1.03
18.2.2	Choosing movie	1.27	1.21	1.25
18.2.3	Pick seat	1.35	1.31	1.34
18.2.4	Review order	2.74	2.75	2.75
18.2.5	Order	5.75	4.82	5.76
19	GO-BUSWAY	1.60	1.65	1.62
19.1	Search	1.00	1.01	1.02
19.2	Go to this shelter	1.21	1.23	1.22
19.3	Request GO-JEK	1.00	1.01	1.05
Average		2.23	2.22	2.24
Total of Average		2.23		

Results of testing the sub characteristic time behavior get an average response time 2.23 seconds. These results are compared with the table which is a table 3.20 User Satisfaction Measurement [14]. After comparison, these results are at level 5 with the predicate of "Very Satisfied" with a range of < 3 seconds. This indicates that the application GO-JEK have very good quality in the sub characteristic time behavior.

2. Subcharacteristics Resource Utilization

Testing sub characteristics resource utilization is done by observing the processing resources when the application is used. The results of the observation of the use of memory when an application installs and when the application is run are as follows.

Table 4.32: Testing Result of Subcharacteristic Resource Utilization on iOS Device

Transportation Service Application	iOS	
	Instalation	Running
GO-JEK	83.6 MB	86.7 MB

Based on the observation table above, results compared to indicators of resource utilization table. Table indicator of resource utilization was made by author based on observation of several transportation service application that is similar to GO-JEK and had a rating above 3.5 scale 5. The application were GRAB, UBER and My Bluebird. The results were 83.6 MB for instalation and 86.7 MB for running is located on level 4 with a range of 82-94 MB for the instalation and 78-91 MB for Running. This indicates that the application gojek have good quality in sub characteristics resource utilization.

3. Subcharacteristics Capacity

Testing result sub characteristic capacity is done by observing the maximum limit of GO-JEK application when processing multiple orders. The results of these observations are described in the following table.

Table 4.33: Testing Result of Subcharacteristic Capacity on iOS Device

No	Test Case	Actual Case	Actual Result
1	Booked multiple orders with one of GO-JEK service.	Booked multiple orders GO-RIDE 7 times.	Applications can process all orders well.
2	Booked multiple orders with some of GO-JEK service.	Booked multiple order GO-CAR and GO-SEND	Applications can process all orders well.
3	Add items into the shopping cart as many as 100 items when using the GO-MART.	Add items from Alfamart store into a shopping cart as many as 100 items.	Applications GOJEK can add items to the shopping cart more than 100 items.
4	Adding food in a shopping cart of 100 items when using the GO-FOOD.	Adding food in resto HokBen in a shopping basket of 100 items	Applications can add items to the shopping cart more than 100 items.

Based on the observation table above, the results compared with a table capacity indicator. Table capacity indicator was made by author based on observation of the features in the application GO-JEK about capacity and application capabilities to the limit. The results of these observations are "All

testcase in accordance with the expectation result" which is located at level 5. This indicates that the application GO-JEK has a very high capacity.

Based on the test results the following sub characteristics above is a summary of test results for characteristic effeciency performance outlined in the following table.

Table 4.34: Testing Result of Characteristic Performance Effeciency on iOS Device

No	Subcharacteristics	Result	Level	Predicate
1	Time Behavior	2.23 second	5	Very Satisfied
2	Resource Utilization	83.6 MB Instalation 86.7 MB Running	4	Good
3	Capacity	All testcase in accordance with the expectation result	5	Very High Capacity

4.4.3 Characteristic Compatibility Testing

In accordance with the research instrument and data analysis techniques described in the previous chapter, the test for compatibility characteristics is divided into two sub-characteristics, there are sub characteristics coexistence and interoperability. For further explanation is as follows.

1. Subcharacteristics Co-Existence

Co-existence testing intended to determine the ability of an application running on the certain device and operating system. Therefore, testing subcharacteristic co-existence on the iOS as the same as described on Android because in the test plan, iOS device has been tested.

2. Subcharacteristics Interoperability

Interoperability testing is intended to determine the ability of an application exchanging information with other systems. Here are the results of interoperability testing of sub characteristics test plan based scenario testing that has been described in previous chapters.

Table 4.35: Test Plan for Subcharacteristic Interoperability Testing on iOS Device

No	Test Case	Actual Results
1	Enter your name and phone number from a contact when booking process available in the phone user.	YES, success to access the contacts and success to enter the name and phone number on the data from the contact in phone.
2	Call driver	YES, success to display a number of calls to the driver automatically.
3	SMS driver	YES, sucess to display the menu screen message that ready to send a message to the number of driver.
4	Call Support	NO, failed to make a call to customer service GOJEK automatically, because the call support provides the option to write a message or a call proceeding.
5	Rate this App	YES, success to access GOJEK in PlayStore / Appstore to rate the app.
6	Forget password	YES, success to send a password reset email that was written to the user.
7	Maps	YES, sucess to display Google Maps.

Based on the observation table above, the results compared with the indicator table interoperability. Table indicator of interoperability is made by the author based on observation of the application when the ability to exchange information with other applications or systems. The results of these observations is "There is 1-2 testcase that does not accordance with the expectation result" which is located at level 4. This shows that the GO-JEK application interoperability is good.

Based on the above test results sub characteristic, The summary of test results for Compatibility characteristic outlined in the following table.

Table 4.36: Testing Result of Characteristic Compatibility on iOS Device

No	Subcharacteristics	Result	Level	Predicate
1	Co-Existence	All the test results in accordance with the expectation result	5	Very Good
2	Interoperability	There is 1-2 testcase that does not accordance with the expectation result	4	Good

4.4.4 Characteristic Usability Testing

Measurements on the characteristic usability aims to ensure the application GO-JEK is easy to use or access and can give satisfaction in use. Because the testing is done by distributing questionnaires based on the user's perspective, the results of testing on iOS characteristic usability same with in testing on android device.

4.4.5 Characteristic Reliability Testing

In accordance with the research instrument and data analysis techniques described in the previous chapter, the test for characteristic reliability is based on observations of the functions related to the application reliability when used in certain conditions. In testing characteristic reliability, there is one subcharacteristic that is maturity with further explanation as follows.

1. Subcharacteristics Maturity

Maturity testing aims to ensure the application GO-JEK can survive from the failure or software error. Here are the results of testing sub maturity characteristic test plan based scenario testing that has been described in previous chapters.

Table 4.37: Testing Result of Subcharacteristic Maturity on iOS Device

No	Test Case	Actual Result	
1	Turning off the the Internet connection with disable data packet or wifi when ordering process GO-JEK service.	YES	The booking process was not continued and application GO-JEK provide notification there is no internet access.
2	Turning on airplane mode when you're ordering process GO-JEK service.	NO	The system only gives notification booking error and did not give notification that airplane mode is on, turn off to continue the process
3	Running multiple applications to use a lot of RAM usage, and then run the GO-JEK application.	YES	GO-JEK application continues to run and can be used with the processing time of less than 6.83 second.
4	Giving too many instructions such as requesting many functions almost simultaneously.	YES	GO-JEK applications can continue to run even if the processing wait time longer than normal.

Based on the observation table above, the results compared with a maturity indicator table. The results of these observations are "There are 3 testcase in accordance with expectation result." Which is located at level 4. This suggests that the ability of GO-JEK applications for defense applications of failures or errors is high.

Based on the test results the following sub above characteristics is the summary of the test results for the Reliability characteristic described in the following table.

Table 4.38: Testing Result of Characteristic Reliability on iOS Device

No	Subcharacteristics	Result	Level	Predicate
1	Maturity	There are 3 testcase in accordance with expectation result.	4	Defense applications of failures or errors is high.

4.4.6 Characteristic Security Testing

In accordance with the research instrument and data analysis techniques described in the previous chapter, testing for security characteristic is divided into five sub karakteridtik, there are sub characteristic confidentiality, integrity, non-repudiation, accountability and authenticity. For further explanation is as follows.

1. Subcharacteristics Confidentiality

Confidentiality testing aimed at determining if the application GO-JEK capable of providing protection permissions on each user. Here are the results of testing sub characteristic confidentiality based scenario testing test plan which has been described in previous chapters.

Table 4.39: Testing Result of Subcharacteristic Confidentiality on iOS Device

No	Test Case	Actual Results	$scoreQ_n$
1	Filling the registration data by clearing the data one field.	GO-JEK application leave empty message fields must be filled.	1
2	Filling the registration data with a password that is short or less than 5 characters.	GO-JEK application displays an error message data is password too short "At least eight character".	1
3	Filling the registration data with the name field of one character.	GO-JEK processing registration applications with the name of one character of data.	0
4	Filling the registration data with passwords containing only character.	GO-JEK application displays an error message "Password must be alphanumeric".	1

Table 4.40: Testing Result of Subcharacteristic Confidentiality on iOS Device

No	Test Case	Actual Results	$scoreQ_n$
5	Fill data to confirm the password field is different from the password data to be used.	GO-JEK application displays an error message "Password confirmation does not match the password".	1
6	Filling the registration data with email address is incomplete.	GO-JEK application displays an error message "Email must be in the format: name@email.com"	1
7	Filling the registration data by using an email address that has been used.	GO-JEK application displays an error message “Email has already been taken”	1

Based on the above table are calculated sub characteristic confidentiality testing with Goal-Question- Metrics (GQM) as follows.

$$SS_{confidentiality} = \frac{1+1+0+1+1+1+1}{7} x100\% = 85.71\%$$

The results of these observations is 85.71% which is at level 5. This indicates that the GO-JEK application’s ability to protect access to users is very high.

2. Subcharacteristics Integrity

Testing the integrity is intended to ensure the application GO-JEK able to prevent permissions are not allowed to enter into the system. Here are the results of testing sub integrity characteristic based scenario testing test plan which has been described in previous chapters.

Table 4.41: Testing Result of Subcharacteristic Integrity on iOS Device

No	Test Case	Actual Results	$scoreQ_n$
1	Login: a. Username filled with incorrect data. b. Password is filled with the correct data.	GO-JEK application displays an error message “Customer not found”.	1

No	Test Case	Actual Results	$scoreQ_n$
2	Login: a. Username filled with correct data. b. Password is filled with the incorrect data.	GO-JEK application displays an error message "Email and password don't match".	1
3	Request for reset password	GO-JEK application sends a message to the email for reset password.	1
4	Login with incorrect data more than three times.	Applications GO-JEK block account for 30 minutes.	1
5	Do not open the application more than one week.	GO-JEK application provide notification session expired, it has to log in first.	1

Based on the above table are calculated the sub characteristic integrity testing with Goal-Question- Metrics (GQM) as follows.

$$SS_{integrity} = \frac{1+1+1+1+1}{5} x100\% = 100\%$$

The results of these observations is 100% which is at the level 5. This suggests that the ability of an application to prevent unauthorized access is very high.

3. Subcharacteristics Non-repudiation

Testing non-repudiation is intended to ensure the application GO-JEK able to provide evidence of acts or transactions performed by the user. Here are the results of testing sub characteristics non-repudiation test plan based scenario testing that has been described in previous chapters.

Table 4.42: Testing Result of Subcharacteristic Non-repudiation on iOS Device

No	Test Case	Actual Results	$scoreQ_n$
1	User registration via the GO-JEK application.	Applications GO-JEK provide proof of enrollment registration via email.	1
2	Reservations service GO-JEK through the application.	Booking list can be seen in the history menu at complete order.	1

No	Test Case	Actual Results	$scoreQ_n$
3	Cancellation order service GOJEK through the application.	Booking list can be seen in the history menu at canceled order.	1
4	The booking process has been completed.	GO-JEK application does not provide proof of payment or transaction ordering and billing via email.	0

Based on the table testing above sub characteristics non-repudiation calculated by Goal-Question- Metrics (GQM) as follows.

$$SS_{non-repudiation} = \frac{1+1+1+0}{4} x100\% = 75\%$$

The results of these observations is 75% which is at level 4. This suggests that the ability of the application to give evidence to the actions / transactions performed by users is high.

4. Subcharacteristics Accountability

Testing sub characteristics accountability is intended to ensure the application GO-JEK capable of being able to track all activities or activities performed by the user. Here are the results of testing sub characteristics accountability based scenario testing test plan which has been described in previous chapters.

Table 4.43: Testing Result of Subcharacteristic Accountability on iOS Device

No	Test Case	Actual Results	$scoreQ_n$
1	Open the history order menu.	The system provides information reservation made by the user, such as time and date and details of service booked or canceled by the user.	1
2	Search	The system provides information search results that have been done by the user.	1

No	Test Case	Actual Results	$scoreQ_n$
3	Leave a comment or rating for service driver, beautician, cleaner or masseur.	The rating system provides a list of information or comment that has been given by the user.	0
4	Top up	The system provides information of charging and discharging a list of credit balances.	0.5

Based on the testing table above is calculated by sub characteristic accountability Goal-Question- Metrics (GQM) as follows.

$$SS_{accountability} = \frac{1+1+0+0.5}{4} x100\% = 62.5\%$$

The results of these observations is 62.5% which is at level 4. This suggests that the ability of application to track of events / activities that have been performed by the user is high.

5. Subcharacteristics Authenticity

Testing sub characteristic Authenticity is intended to ensure the application GO-JEK application is able to provide confirmation of the authenticity of the user data. Here are the results of testing sub characteristic Authenticity by scenario testing test plan which has been described in previous chapters.

Table 4.44: Testing Result of Subcharacteristic Authenticity on iOS Device

No	Test Case	Actual Results	$scoreQ_n$
1	Register user data	Aplikasi GO-JEK sends a verification code via email or SMS	1
2	Login on multiple devices without logout first.	Aplikasi GO-JEK does not display information that account was logged in on other devices, and the user can log on another device without having to first log out the previous device.	0

No	Test Case	Actual Results	$scoreQ_n$
3	Changing the password by filling the field for the old password, the new password, confirm the new password.	The password change was successful.	1
4	Replace the data in the account.	Update data successfully performed and account data successfully replaced.	1

Based on the testing table above is calculated by subkarakteristik Authenticity Goal-Question- Metrics (GQM) as follows.

$$SS_{authenticity} = \frac{1+0+1+1}{4} x100\% = 75\%$$

The results of these observations is 75% which is at level 4. This suggests that the ability of the application to confirm the authenticity of the user data is high.

Based on the test results of five sub characteristics, namely the Confidentiality, Integrity, Non-repudiation Accountability, Authenticity above the following is a summary of the results of testing for security characteristic outlined in the following table.

Table 4.45: Testing Result of Characteristic Security on iOS Device

No	Subcharacteristics	Result	Level	Predicate
1	Confidentiality	85.71%	5	GOJEK application capability to gives the user access protection is very high.
2	Integrity	100%	5	GOJEK application capability to prevent unauthorized access is very high.
3	Non-repudiation	75%	4	GOJEK application capability to give evidence to the actions / transactions performed by users is high.
4	Accountability	62.5%	4	GOJEK application capability to track of events / activities that have been performed by the user is high.
5	Authenticity	75%	4	GOJEK application capability to confirm the authenticity of the user data is high.

4.5 Quality in Use Measurement of Transportation Service Application GO-JEK

Measurement Transportation Service Application GO-JEK on the Quality in Use dimension is done with a questionnaire. Because Quality in Use (QinU) is defined as "the capability of a software product to influence the user's effectiveness, productivity, safety and satisfaction to satisfy their actual needs when using the software product to achieve their goals in a specified context of use". Respondents who filled the questionnaire is the same as respondents who filed questionnaire characteristics usability with certain sample respondents are GO-JEK users who have IT educational background. Before the questionnaires distributed, tested the validity and reliability of the 30 respondents. Validity and reliability result is as follows.

4.5.1 Validity Results

The validity result can be seen by using the Pearson Correlation value between each variable item with the variable it self. The minimum number of Pearson Correlation value to be valid for the research is 0,3610 [27]. It refers to Table R by using the value of signicance level at 5% with 30 number of sample [27]. Below is the validity test result from quality in use dimension instrument.

Table 4.46: Validity Result from Quality in Use Dimension Instruments

Instrument	Pearson Correlation $r_{hitung}(r_{xy})$	R Table r_{table}	Significance Level	Validity
Eftv01	0.907**	0.3610	0.01	Valid
Eftv02	0.818**	0.3610	0.01	Valid
Efcn01	0.935**	0.3610	0.01	Valid
Efcn02	0.940**	0.3610	0.01	Valid
Usef01	0.900**	0.3610	0.01	Valid
Usef02	0.906**	0.3610	0.01	Valid

Instrument	Pearson Correlation $r_{hitung}(r_{xy})$	R Table r_{table}	Significance Level	Validity
Trs01	0.872**	0.3610	0.01	Valid
Trs02	0.930**	0.3610	0.01	Valid
Pls01	0.854**	0.3610	0.01	Valid
Pls02	0.873**	0.3610	0.01	Valid
Cmf01	0.755**	0.3610	0.01	Valid
Cmf02	0.771**	0.3610	0.01	Valid
EcoRM	1.000**	0.3610	0.01	Valid
HSRM	1.000**	0.3610	0.01	Valid
CCmp	1.000**	0.3610	0.01	Valid

Description:
Eftv = Effectiveness
Efcn = Efficiency
Usef = Usefulness
Trs = Trust
Pls = Pleasure
Cmf = Comfort
EcoRM = Economic risk mitigation
HSRM = Health and safety risk mitigation
CCmp = Context Completeness

Based on the validity of the instrument Quality in Use test results in Table 4.46 there were 16 instruments were tested and showed that all the instruments declared "valid" with Pearson Correlation or $r_{hitung}(r_{xy})$ has a value greater than R table or r_{table}. It shows all the instruments that are measured in Quality in Use dimension produce accurate data and reliable with a minimum standard of value $r_{hitung}(r_{xy})$ is 0.3610 and a confidence level is 99%.

4.5.2 Reliabilty Results

After tested the validity, the next stage is the reliability test on each variable. Reliability tests conducted to measure the accuracy and consistency of scores on any instrument that has been filled by the respondent. The accuracy and consistency of scores known from the value of Cronbach-Alpha converted into the category of reliability coefficient. TThe following table is the result of reliability testing on Quality in Use dimension.

Table 4.47: Reliabilty Result from Quality in Use Dimension Instruments

Instrument	Cronbach Alpha	Reliabilty
Eftv01	0.871**	Reliable
Eftv02	0.871**	Reliable
Efcn01	0.912**	Reliable
Efcn02	0.912**	Reliable
Usef01	0.895**	Reliable
Usef02	0.895**	Reliable
Trs01	0.892**	Reliable
Trs02	0.892**	Reliable
Pls01	0.874**	Reliable
Pls02	0.874**	Reliable
Cmf01	0.803**	Reliable
Cmf02	0.803**	Reliable
EcoRM	1.000**	Reliable
HSRM	1.000**	Reliable
CCmp	1.000**	Reliable

Tabel 4.47 shows there were 16 items instrument usability characteristic and generate Cronbach Alpha value of the average is above 0.8. Based on Reliability Index Criteria [27], all instruments are tested on usability characteristic generate data with high reliability or consistency. This shows that all instruments are measured generate trustworthy data.

4.5.3 Questionnaire Quality in Use Results

After tested the validity and reliability of questionnaires to 30 people and the results show that all the items on the questionnaire is valid and reliable, questionnaires were distributed to 100 respondents were sampled with the criteria described in the previous chapter. The following are the results of the questionnaire based on the answers of respondents to Quality in Use.

Table 4.48: Response from Respondents Quality in Use Questionnaire

Instrument	Frequency Response from Respondents					Total Respondents	Modus
	STS	TS	N	S	SS		
Eftv01	2	1	21	53	23	100	S
Eftv02	1	1	14	53	31	100	S
Efcn01	1	2	21	47	29	100	S
Efcn02	1	2	41	39	17	100	N
Usef01	1	1	32	48	18	100	S
Usef02	1	1	17	54	27	100	S
Trs01	1	2	16	65	16	100	S
Trs02	3	5	30	47	15	100	S
Pls01	1	4	30	51	14	100	S
Pls02	1	4	32	48	15	100	S
Cmf01	2	1	17	63	17	100	S
Cmf02	1	4	27	49	19	100	S
EcoRM	1	17	40	29	13	100	N
HSRM	2	10	42	40	6	100	N
CCmp	2	4	18	63	13	100	S

After obtained the results as the table above, the scale is calculated using a formula that has been described in previous chapters to get the value feasibility of characteristic usability. The calculations described in the following table.

Table 4.49: Usability Testing Results

Interpretation	Total (I)	Likert Scale (S)	IxS
STS	21	1	21
TS	59	2	118
N	398	3	1194
S	749	4	2996
SS	273	5	1365
Total $\sum IxS$			5694
Maximum value $MaxU$			7500

Furthermore, do the calculations to obtain test results usability characteristic. The calculations are as follows.

$$\frac{\sum IxS}{MaxU} x100\% = \frac{5694}{7500} x100\% = 75.92\%$$

Based on the above calculation, the results of testing for Quality in Use dimenion is 75.92% then compared with indicators score interpretation table. Hasil pengujian dimensi quality in use berada pada level 4 dengan range

61% - 80%. Results of testing the usability characteristic are at level 4 with a range of 61% - 80%. Meanwhile, the table Response from Respondents, mode or answers that have frequencies that often arises is agree or "S". These things show the quality of its application GO-JEK when used are within the criteria of effectiveness, efficiency, satisfaction, freedom from risk and contex coverage is good.

4.6 Testing Result Summary of Transportation Service Application GO-JEK

Each score calculation of each characteristic and sub characteristics of ISO 25010 on the dimensions of Product Quality and Quality in Use has been successfully carried out on a transportation service application GO-JEK. After that value sub characteristics by observation or questionnaire results shown by the level of the indicator, the level value calculated by weighting subkarakteristik to see whether the calculation result is equal to or lower weight than the relatives weight. The result of the calculation of product quality on the android device is described in the following table.

Table 4.50: Product Quality Testing Result on Android Device

Characteristics	Relative Weight	Sub-characteristics	Relative Weight per sub char (Wn)	Level (L_n)	Value Subchar ($valueSCn$)	Value char ($valueCn$)
1. Functional Suitability	20.72%	1.1 Functional Completeness	6.18%	5	6.18%	20.72%
		1.2 Functional Correctness	6.32%	5	6.32%	
		1.3 Functional Appropriateness	8.22%	5	8.22%	

Characteristics	Relative Weight	Sub-characteristics	Relative Weight per sub char (Wn)	Level (L_n)	Value Subchar ($valueSCn$)	Value char ($valueCn$)
2. Performance Efficiency	12.57%	2.1 Time Behaviour	3.36%	4	2.68%	10.75%
		2.2 Resource Utilization	5.70%	4	4.56%	
		2.3 Capacity	3.51%	5	3.51%	
3. Compatibility	5.12%	3.1 Co-existence	2.60%	5	2.60%	4.62%
		3.2 Interoperability	2.52%	4	2.02%	
4. Usability	23.10%	4.1 Appropriateness Recognizability	7.42%	4	5.94%	18.48%
		4.2 Learnability	3.07%	4	2.45%	
		4.3 Operability	4.75%	4	3.80%	
		4.5 User Interface Aesthetics	5.59%	4	4.47%	
		4.6 Accessability	2.27%	4	1.82%	
5. Reliability	3.33%	5.1 Maturity	3.33%	4	2.66%	2.66%
6. Security	26.53%	6.1 Confidentiality	4.28%	5	4.28%	22.07%
		6.2 Integrity	4.46%	4	3.56%	
		6.3 Non-repudiation	8.00%	4	6.4%	
		6.4 Accountability	6.14%	4	4.91%	
		6.5 Authenticity	3.65%	4	2.92%	
Sum of Total Weights	91.37%	Product Quality Testing Result on Android Device				79.30%

Table 4.51 shows that the quality of service application trasnportation GO-JEK on Product Quality dimension on android device is 79.30%. These results indicate that the quality of the GO-JEK, 12.07% below the maximum

weight value quality mobile applications is 91.37%. Overall quality of the application GO-JEK are at level 4 and 5. This shows the quality of the application GO-JEK dimensions of product quality are tested on android devices already good. Besides tested on android devices, applications GO-JEK tested on iOS devices. The result of the calculation of product quality on the iOS device is described in the following table.

Table 4.51: Product Quality Testing Result on iOS Device

Characteristics	Relative Weight	Sub-characteristics	Relative Weight per sub char (Wn)	Level (L_n)	Value Subchar ($valueSCn$)	Value char ($valueCn$)
1. Functional Suitability	20.72%	1.1 Functional Completeness	6.18%	5	6.18%	20.72%
		1.2 Functional Correctness	6.32%	5	6.32%	
		1.3 Functional Appropriateness	8.22%	5	8.22%	
2. Performance Efficiency	12.57%	2.1 Time Behaviour	3.36%	5	3.36%	11.43%
		2.2 Resource Utilization	5.70%	4	4.56%	
		2.3 Capacity	3.51%	5	3.51%	
3. Compatibility	5.12%	3.1 Co-existence	2.60%	5	2.60%	4.62%
		3.2 Interoperability	2.52%	4	2.02%	

Characteristics	Relative Weight	Sub-characteristics	Relative Weight per sub char (Wn)	Level (L_n)	Value Subchar ($valueSCn$)	Value char ($valueCn$)
4. Usability	23.10%	4.1 Appropriateness Recognizability	7.42%	4	5.94%	18.48%
		4.2 Learnability	3.07%	4	2.45%	
		4.3 Operability	4.75%	4	3.80%	
		4.5 User Interface Aesthetics	5.59%	4	4.47%	
		4.6 Accessability	2.27%	4	1.82%	
5. Reliability	3.33%	5.1 Maturity	3.33%	4	2.66%	2.66%
6. Security	26.53%	6.1 Confidentiality	4.28%	5	4.28%	22.97%
		6.2 Integrity	4.46%	5	4.46%	
		6.3 Non-repudiation	8.00%	4	6.4%	
		6.4 Accountability	6.14%	4	4.91%	
		6.5 Authenticity	3.65%	4	2.92%	
Sum of Total Weights	91.37%	Product Quality Testing Result on Android Device				80.88%

Table 4.52 shows that the quality of service application trasnportation GO-JEK on Product Quality dimension on iOS devices is 80.88%. These results indicate that the quality of the GO-JEK, 10.49% below the maximum weight value quality mobile applications is 91.37%. Overall quality of the application GO-JEK are at level 4 and 5. This shows the quality of the application GO-JEK dimensions of product quality is tested on iOS devices has been good.

On the product quality dimension testing on the device operating system android and iOS, while the dimensions of Quality in Use is done with a questionnaire for Quality in Use is a quality application assessed from user's

perspectif. The following table is the result of the calculation on the quality dimension of Quality in Use.

Table 4.52: Quality in Use Testing Result

Characteristics	Relative Weight	Sub-characteristics	Relative Weight per sub char (Wn)	Level (L_n)	Value Subchar ($valueSCn$)	Value char ($valueCn$)
1. Effectiveness	9.54%	1. Effectiveness	9.54%	4	7.63%	7.63%
2. Efficiency	9.54%	2. Efficiency	9.54%	4	7.63%	7.63%
3. Satisfaction	47.52%	3.1 Usefulness	10.15%	4	8.12%	38.44%
		3.2 Trust	15.70%	4	12.56%	
		3.3 Pleasure	11.61%	4	9.28%	
		3.4 Comfort	10.06%	4	8.48%	
4. Freedom from risk	16.64%	4.1 Economic risk mitigation	8.60%	4	6.88%	22.52%
		4.2 Health and safety risk mitigation	8.04%	4	6.43%	
5. Context Coverage	11.51%	5.1 Context Completeness	11.51%	4	9.21%	
Sum of Total Weights	94.75%	Quality in Use Testing Result				76.22%

Table 4.53 shows that the quality of transportation service application GO-JEK on the Quality in Use dimension is 76.22%. The results of the weight difference of dimensions of quality in use 18.53% from maximum for quality mobile applications. Overall, quality transportation service application GO-JEK has been good from the perspective of the user, for each characteristic is at level 4.

Furthermore, author will describe results of quality on every sub characteristic using priority rangking table. This is done to ensure the criteria in the transportation service application GO-JEK fulfil the quality characteristics of the weights based on the relatives weight of ranking the priority Product

Quality and Quality in Use. Here is a table with results ranking priority measurement quality on Product Quality dimension.

Table 4.53: Priority Ranking Result of Product Quality Dimension

No	Subcharacteristics	Ranking	Relative Weight	Result Android	Result iOS
1.3	Functional appropriateness	1	8.22%	8.22%	8.22%
6.3	Non-repudiation	2	8.00%	6.4%	6.4%
4.1	Appropriateness recognizability	3	7.42%	5.94%	5.94%
1.2	Functional Correctness	4	6.32%	6.32%	6.32%
1.1	Functional Completeness	5	6.18%	6.18%	6.18%
6.4	Accountability	6	6.11%	4.91%	4.91%
2.2	Resource Utilization	7	5.70%	4.56%	4.56%
4.5	User Inter-faceAesthetics	8	5.59%	4.47%	4.47%
4.3	Operability	9	4.75%	3.80%	4.46%
6.2	Integrity	10	4.46%	3.56%	4.28%
6.1	Confidentially	11	4.28%	4.28%	4.28%
6.5	Authenticity	12	3.65%	2.92%	2.92%
2.3	Capacity	13	3.51%	3.51%	3.51%
2.1	Time Behaviour	14	3.36%	2.68%	3.36%
5.1	Maturity	15	3.33%	2.66%	2.66%
4.2	Learnability	16	3.07%	2.45%	2.45%
3.1	Co-existence	17	2.60%	2.60%	2.60%
3.2	Interoperability	18	2.52%	2.02%	2.02%
4.6	Accessibility	19	2.27%	1.82%	1.82%
Sum of Weight Total			91.37%	79.30%	80.88%

Table 4.54 shows that the transportation service application GO-JEK fulfil the criteria of the most important characteristics that should be required with the percentage of each sub characteristics quality in accordance with the percentage of properly. As for the dimensions of quality in use, with a priority ranking table measurement quality results in the following table.

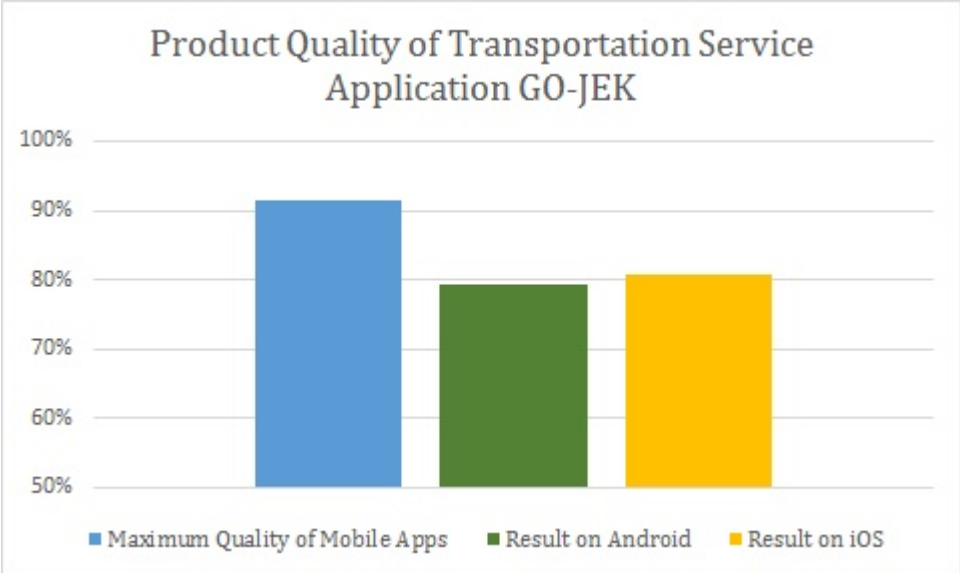
Table 4.54: Priority Ranking of Relative Weight Quality in Use Dimension

No	Subcharacteristics	Ranking	Relative Weight	Result
3.2	Trust	1	15.70%	12.56%
3.3	Pleasure	2	11.61%	9.28%
5.1	Context Completeness	3	11.51%	9.21%
3.1	Usefulness	4	10.15%	8.12%
3.4	Comfort	5	10.06%	8.48%
2	Efficiency	6	9.54%	7.63%
1	Effectiveness	7	9.54%	7.63%
4.1	Economic Risk Mitigation	8	8.60%	6.88%
4.2	Health and Safety Risk Mitigation	9	8.04%	6.43%
Sum of Weight Total			94.75%	76.22%

Table 4.55 shows the transportation service application GO-JEK sufficient to fulfil the most important criteria needed by the mobile application on the Quality in Use dimension, it is because the overall percentage result under its relative weight.

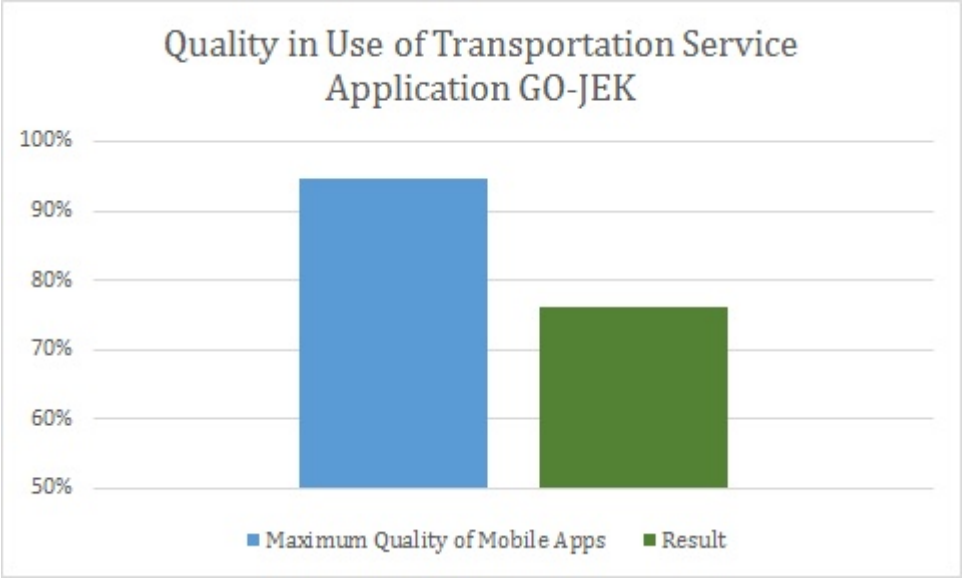
Quality transportation service application GO-JEK has been obtained through the results of the percentage of tests that have been carried out. The final result can also be seen in the chart. Here is a chart for the dimensions of product quality.

Figure 4.5: Product Quality of Transportation Service Application GO-JEK



While the following is a chart for the dimensions of quality in use.

Figure 4.6: Quality in Use of Transportation Service Application GO-JEK



Chapter 5

CONCLUSIONS AND FUTURE WORKS

5.1 Conclusions

Measuring the quality of trasnportation service application GO-JEK using ISO 25010 Quality Model has been successfully carried out by the methods that have been determined. Overall, the GO-JEK application obtain the value of good quality with a percentage on product dimensional quality is equal to 79.30% on a android device and on iOS devices 80.88% of the maximum value of mobile application quality by 91.37%. This shows the application GO-JEK have good quality in terms of functional, performance, compatibility, usability, reliability and security. GO-JEK quality of applications in the operating system iOS has a value of higher quality than the android operating system for iOS for some sub characteristic are at a higher level than the android. Subcharacteristic is Operability, Integrity and time behavior. This indicates that the quality of the GO-JEK better on iOS devices to provide ease of operation, preventing the access rights and response time.

On the Quality in Use dimension, the quality of trasnportation service application GO-JEK is 76.22% of the maximum value of mobile application quality is 94.75%. The results of the weight difference of Quality in Use dimension and maximum of quality mobile applications is 18.53%. Overall, quality transportation service application GO-JEK has been good from the user's perspective, for each characteristic is at level 4 is the predicate good quality.

5.2 Future Works

Measuring the quality of trasnportation service GO-JEK using ISO 25010 Quality Model is open to be developed. Measuring the quality of service application trasnportation GO-JEK needs to be done with various types of testing that is more diverse and need to use tools for multiple characteristics on dimensions of product quality, so we get more accurate results. In addition to filling out the questionnaire on usability characteristics and dimensions of quality in use need to be spread area in the Indonesian region that has been reached by the application GO-JEK.

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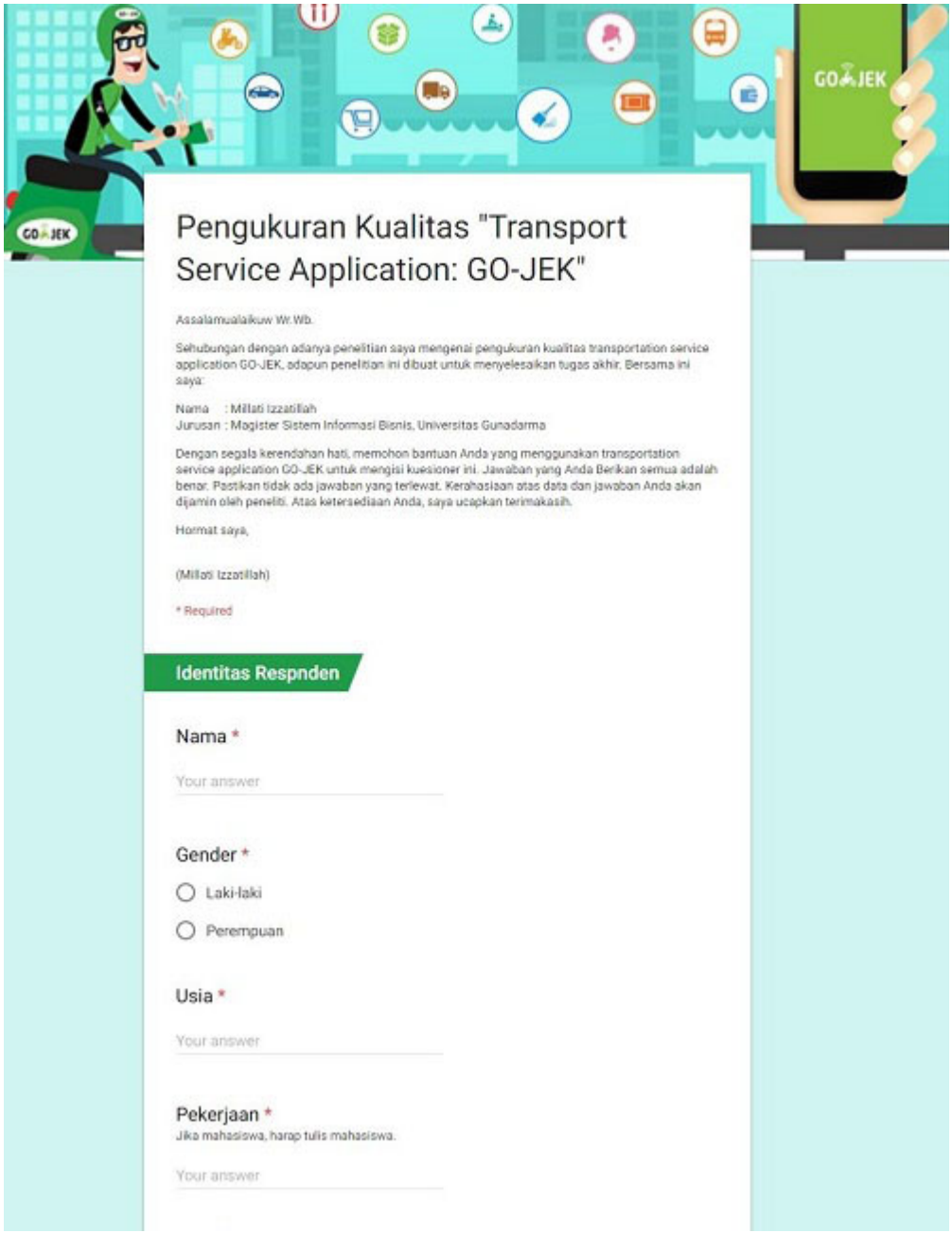
APPENDIX

Appendix 1. Usability Characteristic and Quality in use Questionnaire



Gelar *
Tulis Gelar anda, misal S.Kom/ S.T/M.TI/M.MSI. Jika mahasiswa harap tulis jurusan.

Your answer

Domisili *

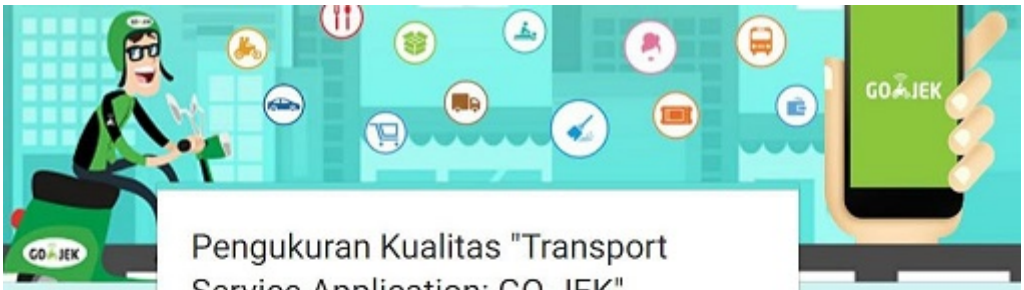
Choose

Lamanya menggunakan transportation service application pada smartphone Anda *
Tulis tahun nya saja, misal 2015.

Your answer

Nomor Handphone
Opsional untuk hadiah pulsa elektronik

Your answer



Pengukuran Kualitas "Transport Service Application: GO-JEK"

* Required

Kualitas transportation service application GO-JEK

Pernyataan-pernyataan di bawah ini berkaitan dengan persepsi Anda terhadap kualitas aplikasi GO-JEK pada smartphone Anda. Berikut ini adalah skala pada setiap pernyataan-pernyataan dalam mengisi kuesioner ini.

1 = Sangat Tidak Setuju
2 = Tidak Setuju
3 = Netral
4 = Setuju
5 = Sangat Setuju

A. Karakteristik Usability pada Dimensi Product Quality

1. Saya merasa aplikasi GO-JEK sesuai dengan kebutuhan saya. *

	1	2	3	4	5	
Sangat TIDAK Setuju	○	○	○	○	○	Sangat Setuju

2. Saya merasa aplikasi GO-JEK mudah untuk dipelajari. *

	1	2	3	4	5	
Sangat TIDAK Setuju	○	○	○	○	○	Sangat Setuju

3. Saya mempelajari cara menggunakan aplikasi GO-JEK dengan cepat. *

	1	2	3	4	5	
Sangat TIDAK Setuju	○	○	○	○	○	Sangat Setuju

4. Saya merasa aplikasi GO-JEK mudah untuk digunakan (dioperasikan). *

	1	2	3	4	5	
Sangat TIDAK Setuju	○	○	○	○	○	Sangat Setuju

5. Saya merasa aplikasi GO-JEK membutuh-kan langkah yang singkat ketika digunakan. *

	1	2	3	4	5	
Sangat TIDAK Setuju	○	○	○	○	○	Sangat Setuju

6. Saya merasa aplikasi GO-JEK memberikan pencegahan terhadap kesalahan yang saya lakukan. *

	1	2	3	4	5	
Sangat TIDAK Setuju	○	○	○	○	○	Sangat Setuju

7. Saya merasa aplikasi GO-JEK memberikan pemulihan terhadap kesalahan yang saya lakukan. *

	1	2	3	4	5	
Sangat TIDAK Setuju	○	○	○	○	○	Sangat Setuju

8. Saya merasa aplikasi GO-JEK memiliki tampilan yang user friendly. *

	1	2	3	4	5	
Sangat TIDAK Setuju	○	○	○	○	○	Sangat Setuju

9. Saya merasa aplikasi GO-JEK memiliki tampilan yang konsisten. *

	1	2	3	4	5	
Sangat TIDAK Setuju	○	○	○	○	○	Sangat Setuju

10. Saya merasa aplikasi GO-JEK tetap dapat digunakan dalam berbagai kondisi tertentu. *

Contoh: Aplikasi GO-JEK tetap beroperasi dengan baik ketika diakses oleh banyak user dalam satu waktu.

	1	2	3	4	5	
Sangat TIDAK Setuju	○	○	○	○	○	Sangat Setuju

11. Saya merasa aplikasi GO-JEK dapat digunakan oleh pengguna dengan jangkauan yang luas. *

GO-JEK dapat dijalankan diberbagai platform dan berbagai sistem operasi. GO-JEK juga dapat digunakan oleh berbagai kalangan user.

	1	2	3	4	5	
Sangat TIDAK Setuju	○	○	○	○	○	Sangat Setuju

B. Dimensi Quality in Use

1. Saya merasa aplikasi GO-JEK membantu saya menjadi lebih efektif. *

	1	2	3	4	5	
Sangat TIDAK Setuju	○	○	○	○	○	Sangat Setuju

2. Saya merasa aplikasi GO-JEK membantu pencapaian tujuan saya dengan lebih mudah. *

	1	2	3	4	5	
Sangat TIDAK Setuju	○	○	○	○	○	Sangat Setuju

3. Saya merasa aplikasi GO-JEK menghemat waktu saya ketika saya menggunakannya. *

	1	2	3	4	5	
Sangat TIDAK Setuju	○	○	○	○	○	Sangat Setuju

4. Saya merasa aplikasi GO-JEK membantu saya menjadi lebih produktif. *

	1	2	3	4	5	
Sangat TIDAK Setuju	○	○	○	○	○	Sangat Setuju

5. Saya merasa aplikasi GO-JEK memberikan dampak positif terhadap saya. *

	1	2	3	4	5	
Sangat TIDAK Setuju	○	○	○	○	○	Sangat Setuju

6. Saya merasa aplikasi GO-JEK memberikan manfaat pada saya. *

	1	2	3	4	5	
Sangat TIDAK Setuju	○	○	○	○	○	Sangat Setuju

7. Saya merasa aplikasi GO-JEK memberikan kepercayaan untuk dapat digunakan sesuai dengan kebutuhan saya sebagaimana fungsinya. *

	1	2	3	4	5	
Sangat TIDAK Setuju	○	○	○	○	○	Sangat Setuju

8. Saya percaya aplikasi GO-JEK dapat memenuhi apa yang saya inginkan. *

	1	2	3	4	5	
Sangat TIDAK Setuju	○	○	○	○	○	Sangat Setuju

9. Saya merasa aplikasi GO-JEK menyenangkan untuk digunakan. *

	1	2	3	4	5	
Sangat TIDAK Setuju	○	○	○	○	○	Sangat Setuju

10. Saya merasa aplikasi GO-JEK memberikan kepuasan. *

	1	2	3	4	5	
Sangat TIDAK Setuju	○	○	○	○	○	Sangat Setuju

11. Saya merasa aplikasi GO-JEK nyaman untuk digunakan. *

	1	2	3	4	5	
Sangat TIDAK Setuju	○	○	○	○	○	Sangat Setuju

12. Saya merasa aplikasi GO-JEK adalah aplikasi yang harus saya miliki. *

	1	2	3	4	5	
Sangat TIDAK Setuju	○	○	○	○	○	Sangat Setuju

13. Saya merasa aplikasi GO-JEK membuat saya menjadi lebih hemat. *

	1	2	3	4	5	
Sangat TIDAK Setuju	○	○	○	○	○	Sangat Setuju

14. Saya merasa aplikasi GO-JEK dapat mengurangi risiko kejahatan pada diri saya. *

	1	2	3	4	5	
Sangat TIDAK Setuju	○	○	○	○	○	Sangat Setuju

15. Saya merasa aplikasi GO-JEK memberikan kelengkapan komponen fungsi, fitur maupun konteksnya. *

	1	2	3	4	5	
Sangat TIDAK Setuju	○	○	○	○	○	Sangat Setuju

16. Saya merasa aplikasi GO-JEK fleksibel untuk digunakan.

	1	2	3	4	5	
Sangat TIDAK Setuju	○	○	○	○	○	Sangat Setuju